

***United States Court of Appeals
for the Second Circuit***



AMICUS BRIEF

77 - 6049, et al.

BRIEF FOR RESPONDENT FEDERAL POWER COMMISSION

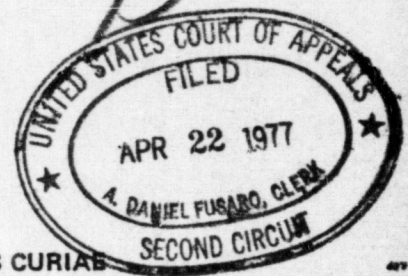
IN THE UNITED STATES COURT OF APPEALS
FOR THE SECOND CIRCUIT

No. 77 - 6049, et al.

Secretary of the Interior, et al.,
Petitioners,

v.

County of Suffolk, New York, et al.,
Respondent.



BRIEF OF FEDERAL POWER COMMISSION AS AMICUS CURIAE

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WASHINGTON, D. C. 20426.

APRIL 15, 1977

IN THE UNITED STATES COURT OF APPEALS
FOR THE SECOND CIRCUIT

Secretary of the Interior, <u>et al.</u> ,	)	
Petitioners,	)	
	)	
v.	)	No. 77-6049, <u>et al.</u>
	)	
County of Suffolk, New York, <u>et al.</u> ,	)	
Respondents.	)	

BRIEF OF FEDERAL POWER
COMMISSION AS AMICUS CURIAE

COMMISSION'S INTEREST

Pursuant to Rule 29 of the Federal Rules of Appellate Procedure, the Federal Power Commission (Commission) as amicus curiae, respectfully files this brief in the above-captioned case. The Commission under the Natural Gas Act, 15 U.S.C. §717 et seq., has jurisdiction over the sale and transportation of natural gas in interstate commerce. Furthermore, the Commission is authorized under the Outer Continental Shelf Act, 43 U.S.C. §1331 et seq., to determine the proportional amounts of gas transported or purchased by pipelines obtaining rights of way through submerged lands (43 U.S.C. §1334(c)). The Commission is directly concerned with the decision of the United States District Court for the Eastern District of New York that the leases made in Lease Sale Number 40 of outer continental shelf lands in the mid-Atlantic region of exploration and production of oil and gas are void. For this reason, the Commission files this brief amicus curiae.

DISCUSSION

On February 17, 1977, the District Court enjoined all parties from exercising powers arising from the Interior Department's Lease Sale Number 40 sale of offshore natural gas leases in the Atlantic Outer Continental Shelf because of alleged violations of the National Environmental Policy Act (NEPA), 42 U.S.C. §1321 et seq., by the Secretary of the Interior. The Court further declared that "the Sale 40 leases are void" (Slip Op. p. 1). The decision has been appealed by the Secretary to this Court. This brief will not address the NEPA issues, which are fully canvassed in the Secretary's brief. Nonetheless, the Commission believes that it can materially aid the Court with a description of the critical natural gas supply crisis facing the country today.

With the winter of 1976-77, the country has become directly aware that natural gas is drastically short in supply. What is less evident is that the events of this winter and the movement towards our present supply posture were predicated years ago, 1/ and with the trend of natural gas supply deficiencies continuing, serious economic dislocations are a distinct possibility in future years. Clearly then, the country is confronted with a compelling need to develop all conventional and non-conventional gas supply possibilities. As we will show, infra, offshore exploration and development is an integral part of the country's attempt to meet the worsening energy crisis.

1/ President's Material Policy Commission, June 1952.

I. Reserve Additions And Production Of Natural Gas.

Conservation of our energy resources is the most fundamental aspect of our national energy program. Natural gas and oil provide three-quarters of the country's present energy supply, and in order to stabilize an increasingly unsettled energy environment we will have to vigorously conserve these resources. Even with additional efforts to develop coal, nuclear, solar and geothermal energy, the country's need for natural gas and oil undoubtedly will remain constant, and most probably will increase. The country's reliance on a plentiful and low-cost resource must change to a policy reflecting a decreased supply and higher costs. Continuing the supply of natural gas will facilitate this transition.

Most important to our effort to maintain a balanced energy program will be the exploration and development of the offshore Federal Domain. It is there where much of our potential supplies of both oil and gas are located. Commercial feasibility of these areas will depend, among other things, on the continuing discovery of gas reserves, ^{2/} the rate at which these resources can be developed and the cost of producing gas from those reserves.

^{2/} "Reserves" in this brief refers to proved reserves.

Offshore reserves and their production are gaining increasing significance. For example, in 1956 the Southern Louisiana offshore Federal Domain contributed less than one (1) percent of the gas produced domestically. By 1971, it was contributing over 11%. Annual additions to proved reserves in this area have become even more important: during the period between 1968-1972 the offshore domain yielded nearly one-third of the total U.S. reserve additions developed in the lower 48 states. 3/

The benchmark year for natural gas supply was 1967 in which year-end reserves in the lower 48 states were 289.3 TCF (trillion cubic feet) of gas. 4/ In that year, the reserve to production ratio (R/P) was 15.7. 5/ Since that year, reserves have dropped precipitously to 196.1 TCF in 1975 with a R/P ratio of 10. The R/P ratio for 1974 was 9.7, and the only reason it increased slightly in 1975 was that less gas was produced.

Equally as disturbing is the figure demonstrating that dedications of natural gas to interstate pipelines

3/ Letter from Chairman John N. Nassikas to the Honorable Rogers C.B. Morton, Appendix A, infra.

4/ FPC Staff Comments On Possible Sale Of Oil And Gas Leases In The North Atlantic Area, June 5, 1975 (Appendix B, infra).

5/ The "R/P ratio" is the number of years of supply remaining at the current rate of production without any new reserve additions.

have also declined. In 1975, interstate reserves 6/ declined for the eighth consecutive year to a year-end level of 106.8 TCF. The 13.7 TCF deficiency between production and reserves added for 1975 brought the interstate pipeline R/P ratio down to 8.9. Those same pipeline companies produced only 12.0 TCF in 1975; 15.5% lower than peak annual volumes of 14.2 TCF in both 1971 and 1972. 7/

While year-end reserves and annual additions to reserves are declining, production of natural gas is decreasing as well. In 1974, the country experienced the first significant decline in production in the modern history of the natural gas industry. This decline in production in the lower 48 states continued through 1975 and preliminary data indicate that it will, in all likelihood, continue in 1976, although at a reduced rate. To the extent that gas supplies can be predicted, the Bureau of Natural Gas of the Federal Power Commission concludes that:

[P]roduction from present gas supply areas will have decreased by about one third to about 14 TCF by 1985, and that even with successful development of the offshore areas of the Atlantic, Pacific and Alaska, overall production will have dropped about 20 percent to approximately 17 TCF by 1985.

6/ "Interstate reserves" refers to the gas which is owned by or dedicated (contracted) to interstate pipeline companies.

7/ The Gas Supplies of Interstate Natural Gas Pipeline Companies, 1975, January, 1977.

Statement by Gordon K. Zareski, Chief, Resource Evaluation and Analysis Division, Bureau of Natural Gas, Hearings Before the House Subcommittee on Energy and Power, Committee on Interstate and Foreign Commerce, March 24, 1977 (Appendix C).

II. Supply-Demand Imbalance.

As can be seen, the Bureau of Natural Gas expects the supply-demand imbalance, which has been developing for years, to widen in the future. Another group monitoring the gas supply-demand profile, the Gas Requirements Committee, 8/ estimated that from November 1974 to March 1975 only 86% of the anticipated national demand for natural gas could be met from currently contracted or reasonably assured supplies. 9/ In all probability, supply deficiencies will continue at least into 1990.

In addition, the gas supply for interstate pipelines is deteriorating at an even faster rate than the national supply. Interstate reserves have dropped 46% from their 1967 peak year to 1975, and interstate production has declined 15.5% since 1972.

8/ The Gas Requirements Committee is sponsored by the Gas Requirements Agency, Denver Research Institute, University of Denver, and is composed of members of gas producing, pipeline and distribution industry, observers from state and Federal regulatory bodies, American Gas Association, American Petroleum Institute, Independent Natural Gas Association of America and the National Association of Regulatory Utility Commissioners.

9/ By 1980, the Gas Requirements Committee estimates that supply will only satisfy 74% of requirements.

The current supply-demand imbalance may be exacerbated in the future by an inescapable geological fact: with the possible exception of Alaska, the Atlantic and the Pacific Outer Continental Shelf areas, we have probably found the majority of our large or "significant" fields. 10/ Information developed by the American Association of Petroleum Geologists shows a downward trend in the number of significant gas wells being discovered. The number of significant gas fields discovered declined from 99 in 1975 to 49 in 1969, which is the last year for which a six-year development history was available. 11/

If there had been any previous doubt about our gas supply deficiency, it was rudely dispelled this past winter. Reserves were so depleted that some pipelines had to withdraw "cushion gas" to meet firm service requirements. 12/ As a result, storage has been serverely drawn down and pipeline service to all classes of customers will continue to be hampered by the necessity to replace these volumes prior to the next heating season.

10/ The American Association of Petroleum Geologists defines as "significant" any gas field containing more than 6 billion cubic feet (BCF) of ultimately recoverable proven reserves. A minimum of six years of history is used in making this determination.

11/ Statement by Gordon K. Zareski, supra at p. 7, Appendix C, infra.

12/ "Cushion gas" is that gas which should be kept in storage fields to maintain the pressure necessary for withdrawal of gas at the rates required.

Nearly every major pipeline has had to curtail deliveries of natural gas to its customers over the past seven years. In fact, during this past winter, some pipelines have curtailed into Priority I, which serves "human needs." ^{13/} Because of the growing supply-demand imbalance, curtailments will continue to increase. Projected firm service deficiencies for the year September 1976 to August 1977 were 3,771 BCF, or about 26% of net firm service requirements. ^{14/} This is attributable to the failure to develop new supplies of natural gas at a pace sufficient to meet contractual demands.

III. Offshore Atlantic Reserves.

Development of the offshore Federal Domain's natural gas resources would contribute to the improvement of our supply-demand profile. To the extent that the Atlantic OCS holds commercial quantities of natural gas, we must develop these resources to retard the further deterioration of our supplies. The U.S.G.S. has estimated that the undiscovered recoverable natural gas which may be found in the Atlantic OCS is between 5 and 14 TCF, with a statistical mean value of 10 TCF. ^{15/}

^{13/} That category generally includes residential service and service to customers such as hospitals.

^{14/} FPC News Release No. 22761, Projected Gas Curtailment report, Schedule I, December 6, 1976.

^{15/} Geological Estimate of Undiscovered Recoverable Oil and Gas Resources in the United States, U.S.G.S. Circular 725, p. 31, June 20, 1975.

Any offshore gas, which is found and produced in the North Atlantic area, will assist the adjacent coastal states that sought to enjoin the sale of the leases in question. While those states have legitimate environmental apprehensions, the hard fact is that those states, and more particularly the Northeast region of the country, are the ones which are traditionally so dependent on natural gas. Each of the four major pipelines servicing that area are experiencing severe curtailment in firm service. Available figures indicate that between September 1976 and August 1977; Columbia Gas Transmission Corporation projected system-wide firm curtailments of 28.1%; Tennessee Gas Pipeline Company's projections were 18.2%; Texas Eastern Transmission Corporation's projections were 27.7%; and Transcontinental Gas Pipe Line Corporation's projections were 46.0%. 16/ In 1975, these pipelines delivered about 1,085 BCF to the states adjacent to the Sale 40 leases in the Atlantic. 17/ Clearly, the Atlantic offshore area will help to ease the critical shortage for the adjacent states.

Failure to develop this area can only force the use of alternative fuels, which in most cases are less environmentally sound. Coal, with its sulphur content, is dirtier than natural gas and its use would certainly result in

16/ FPC News Release No. 22761, supra.

17/ Id.

adverse environmental impact. Imported gas from Canada is becoming financially prohibitive and the Canadian National Energy Board forecasts that it will not have gas available in 1985.

FPC Chairman Nassikas writing in 1972 to Rogers C.B. Morton, Secretary of the Interior, succinctly stated the advantages of natural gas (Appendix C, p. 6):

The availability of environmentally acceptable fuels for heating homes, cooking meals, and supplying energy for the manufacture of products certainly contributes to the preservation of man's environment. Because of its lack of sulfurous emissions, natural gas is a premium fuel in the battle to preserve and protect the quality of the air man breathes. Environmental concern must embrace a broader prospective than just the local area surrounding the lease here under consideration and the environmental benefits in those regions where this gas will be consumed must be a part of the environmental consideration.

CONCLUSION

The prospects for relief from the current natural gas crisis are minimal. The need for new sources of natural gas is acute, and the luxury of delay in exploration and development has long since passed. The country needs immense quantities of gas now. The frontier areas of the Atlantic and Pacific Outer Continental Shelf and Alaska are believed to have the potential for significant future discoveries. Exploration and development of those areas must be given high priority so that our energy needs and demands will be met. The District Court's nullification of the Sale Number 40 leases directly hinders the efforts to ameliorate the burdens of the energy crisis.

For the foregoing reasons, the Commission respectfully supports the appeal of the Secretary of Interior in this cause.

Respectfully submitted,

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Federal Power Commission
Washington, D.C. 20426
202-275-4258
April 15, 1977

APPENDIX A

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

IN REPLY REFER TO:

September 1, 1972

Honorable Rogers C. B. Morton
Secretary of the Interior
Washington, D. C. 20240

Dear Mr. Secretary:

The continuing imbalance between natural gas supply and demand is a matter of primary concern of the Federal Power Commission and one which occupies a major part of our attention. The development of supplies continues to fall short of replacing increasing demands. While many factors affect this balance, it appears that one of the major problems is that of inadequate resource development. To meet our responsibilities of fostering the timely development of potential, but not yet deliverable, gas resources the Federal Power Commission believes that the proposed leasing of 135 tracts of submerged lands in the Gulf of Mexico offshore Louisiana should proceed without delay. The natural gas potential of this area can and must be developed in a timely manner while still providing the maximum degree of protection to the environment.

Information filed with the Federal Power Commission, (FPC Form 15), indicates that the reserves dedicated to the interstate market have declined for the fourth straight year to 161.3 trillion cubic feet, 36.8 trillion cubic feet below the peak volume reported in 1967. Data on interstate gas reserves and deliverability have been collected by the Federal Power Commission through annual Form 15 reports since 1963. Over that period of time, as shown in the following table, the reserves to production ratio has declined from 20.2 to 11.4. In 1971, natural gas reserves for the contiguous states, as reported by the American Gas Association, decreased for the

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fourth consecutive year to 247.4 trillion cubic feet, 14.5 percent below the peak level of 289.3 trillion cubic feet in 1967. Total U. S. reserve additions in the contiguous states have amounted to less than half of the volume produced during the last four years and the proven reserve inventory has shrunk by 41.9 trillion cubic feet. The reserve to production ratio (R/P) which stood at 24.4 twenty years ago has now dropped to 11.3.

COMPARISON OF A.G.A. 1/ DATA
FORM 15 2/ DATA
(Volumes in Trillions of Cubic Feet)

	END OF YEAR RESERVES		RESERVE TO PRODUCTION RATIO	
	A.G.A.	FORM 15	A.G.A.	FORM 15
1963	274.5	188.5	18.9	20.2
1964	279.4	189.2	18.3	18.9
1965	284.5	192.1	17.5	18.5
1966	286.4	195.1	16.4	17.5
1967	289.3	198.1	15.7	16.8
1968	282.1	195.0	14.6	15.5
1969	269.9	187.6	13.1	14.0
1970	259.6	173.6	11.9	12.3
1971	247.4 <u>3/</u>	161.3 P	11.3	11.4

1/ American Gas Association, Reserves of Crude Oil, Natural Gas Liquids and Natural Gas in the United States and Canada, as of December 31, 1971.

2/ Federal Power Commission, The Gas Supplies of Interstate Natural Gas Pipeline Companies, 1970.

3/ Some reserves resulting from drilling on acreage leased in the December, 1970, Federal lease sale in Offshore South Louisiana are not included because the A.G.A. Reserves Committee did not have sufficient data upon which it could base an estimate of proved reserves as of December 31, 1971.

P/ Preliminary - from Federal Power Commission News Release Number 18513, August 22, 1972.

Curtailments of both firm and interruptible gas service by the major interstate pipeline companies are becoming increasingly widespread with seriously adverse economic results such as switching to move costly, less desirable fuels and a slowing effect on industrial growth in some parts of the Nation. Also in many areas, new gas service to private homes is being denied.

Pipeline companies are experiencing increasing difficulty in contracting for new gas supplies necessary to adequately serve present customers and provide service to all new consumers who are requesting it. Seven companies 1/ reported firm gas curtailments during the 1971-72 heating season. Reports from the companies involved indicate that total curtailments since November of 1971 have exceeded 500 billion cubic feet. Reports filed by interstate pipeline companies this summer indicate that natural gas supply deficiencies for the year extending from April 1972 through March 1973 will be substantially more severe than for the prior year. Firm requirement deficiencies are forecast for 15 companies in the aggregate amount of approximately 1.0 trillion cubic feet for the 12 month period, April 1, 1972 to March 31, 1973. This represents about 9.7 percent of the total annual sales (1970) of these 15 companies. Additionally, the interruptible gas service offered by many of the major pipeline companies is being interrupted much more frequently and for longer periods of time than in the past.

The Future Requirements Committee 2/ has estimated that in 1975 only 86 percent of the anticipated national requirement for natural gas can be met from currently contracted or reasonably

- 1/ Algonquin Gas Transmission Co., Arkansas Louisiana Gas Co., Panhandle Eastern Pipe Line Co., Texas Eastern Transmission Corp., Trunkline Gas Co., and United Gas Pipe Line Company.
- 2/ The Future Requirements Committee is sponsored by the Future Requirements Agency, Denver Research Institute, University of Denver and is composed of members from the gas producing, pipeline, and distribution industry, observers from state and Federal regulatory bodies, American Gas Association, American Petroleum Institute, Independent Natural Gas Association of America and the National Association of Regulatory Utility Commissioners.

assured supplies. The Federal Power Commission staff has independently forecasted an 88 percent fulfillment of anticipated requirements for 1975. Further evidence of the inability to procure domestic natural gas supplies is seen in increasing applications to the FPC to import gas and to synthesize natural gas substitutes from hydrocarbon liquids or naphtha.

The Southern Louisiana area (including both onshore and offshore zones) has played a major role in determining the Nation's natural gas reserve-production position in the past, and is expected to take on increasing significance in the future. In 1971, its contribution had increased to about 35 percent. Production during the period from 1956 through 1971 increased more than five fold. Reserves more than doubled during the same period to a peak of 83.4 trillion cubic feet in 1968 but have since slipped back to 75.0 trillion cubic feet in 1971. Even so, during the past four years more than half of the total U. S. reserve additions of the lower 48 states have been contributed by South Louisiana.

The increasing significance of the Southern Louisiana offshore Federal Domain (Zones 2, 3 and 4) is even more pronounced. In 1956, the Offshore Federal Domain contributed less than one percent of the gas produced domestically. By 1971, its contribution had increased to over 11 percent. Production during the period from 1956 through 1971 increased almost 26 fold. During the past four year period, the South Louisiana Offshore Federal Domain has contributed about one-third of the total U. S. reserve additions developed in the lower 48 states.

The latest estimate of potential natural gas supply by the Potential Gas Committee ^{3/} attributes 145 trillion cubic feet to South Louisiana as a whole, and 99 trillion cubic feet (or more than 68 percent) to the offshore area. The total offshore Louisiana potential comprises almost 12 percent of that estimated for the lower 48 states. These figures illustrate the degree to which the ability of the lower 48 states to meet the growing

^{3/} The Potential Gas Committee is sponsored by The Potential Gas Agency of the Colorado School of Mines and is composed of members from the transmission, distribution and production segments of the gas industry, along with members and observers from state and Federal agencies, Canada, Mexico, and the National Association of Regulatory Utility Commissioners.

demand for natural gas depends on the development of Louisiana's offshore potential. The present state of development of offshore transportation facilities, with numerous pipelines already extending out into the Gulf waters, will shorten the time required to bring these resources to maturity.

The development of these needed resources is, of course, responsive to many factors such as the wellhead prices set by the Federal Power Commission for sales in interstate commerce; the industry's level of technology as it relates to offshore operations; tax policies; the relative attraction between domestic and foreign investments; and leasing policies relating to Federal domain lands. Of these various factors the leasing policy is crucial, for unless promising drilling sites are made available to the oil and gas industry all other efforts to stimulate exploration and development will not achieve their full potential.

The Federal Power Commission has acted on many fronts with regard to meeting its regulatory responsibilities to foster and facilitate an improvement in the gas supply situation. In establishing just and reasonable rates for South Louisiana in Opinion No. 598 issued July 16, 1971, the Commission said:

"Our minimum objective has to be action to halt and hopefully to reverse the downward trend of the reserves-to-production ratio. It is from the Southern Louisiana area that we reasonably can expect the greater portion of total demand for jurisdictional gas to be satisfied in the next few years."

In addition to the increased gas price ceilings contained in Opinion No. 598, the Commission on August 3, 1972, issued Order No. 455 (Statement of Policy Relating to Optional Procedure for Certificating New Producer Sales of Natural Gas) fixing the terms and conditions of an optional procedure under which certificates for the sale of natural gas may be issued. This order, applicable to all gas producing areas of the United States, is intended to spur domestic exploration and development.

Natural gas is an essentially sulfur-free, clean burning fuel at the point of combustion. A commercially acceptable device for the removal of sulfur compounds from flue gas is not available, and to date, the best method of controlling emissions of sulfurous

pollutants is to burn low-sulfur fuels. The availability of environmentally acceptable fuels for heating homes, cooking meals, and supplying energy for the manufacture of products certainly contributes to the preservation of man's environment. Because of its lack of sulfurous emissions, natural gas is a premium fuel in the battle to preserve and protect the quality of the air man breathes. Environmental concern must embrace a broader perspective than just the local area surrounding the leases here under consideration and the environmental benefits in those regions where this gas will be consumed must be a part of the environmental consideration.

Energy is the essential ingredient which this Nation must have to convert raw resources into the products and services that constitute our high standard of living. The growth of our national economy supporting our technologically advanced civilization is dependent on continued adequate supplies of energy.

A number of alternatives to this lease sale have been proposed. However, most of these are not truly alternatives to the development of the hydrocarbon potentials of our Federal Domain Offshore lands. The national gas shortage is at a point where all potential resources must be developed to serve the public interest. But the primary goal must be the development of our indigenous energy supplies.

A primary purpose of the National Environmental Policy Act is to "attain the widest range of beneficial uses of the environment without degradation, risk to health and safety, or other undesirable and unintended consequences." The Act also calls upon the Federal government to use all practicable means to "...achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities." If we are to meet this obligation, the Nation's consumers must be assured an adequate supply of energy. We feel that the proposed lease sale is an important, indeed imperative, element in providing that assurance, and that the public interest can best be served by holding this proposed lease sale at the earliest possible time.

Sincerely,

John N. Nassikas
Chairman

STATEMENT OF THOMAS J. JOYCE, CHIEF, BUREAU OF NATURAL GAS,
FEDERAL POWER COMMISSION, AT THE OUTER CONTINENTAL SHELF
LEASING HEARING, AUGUST 22-23, 1972, NEW ORLEANS, LOUISIANA

MR. EXAMINER AND MEMBERS OF THE PANEL:

My statement in behalf of the staff of the Federal Power Commission will reinforce and update my previous strong support for the further development of the oil and gas potential of the South Louisiana offshore outer continental shelf. In July of 1970 I appeared as a witness in support of the offshore Western Louisiana general lease sale which was subsequently held on December 15, 1970, and again last September I appeared in support of the 86 tract Eastern Louisiana lease sale proposal which has now been scheduled for September 12, 1972. I am here once again today to support the proposed 1972 general lease sale.

The national gas problem continues underscoring the urgency of my previous testimony. During the past year gas reserve additions failed to replace the natural gas produced and the reserve/production (R/P) ratio declined. In 1971, natural gas reserves for the contiguous states as reported by the American Gas Association decreased for the fourth consecutive year to 247.4 trillion cubic feet, 14.5 percent below the peak level of 289.3 trillion

cubic feet in 1967. Total U.S. reserve additions in the contiguous states have been less than half of production during the last four years and the proven reserve inventory has shrunk by 41.9 trillion cubic feet. The R/P ratio which stood at 24.4 twenty years ago has now dropped to 11.3. (See Appendix Table 1). Total exploratory wells drilled also declined in 1971. (See Appendix Table 2.)

In 1971, the interstate reserves (as reported in FPC Form 15) declined for the fourth straight year to 161.3 trillion cubic feet. The 1971 decline was 12.3 trillion cubic feet and brought the R/P ratio for the interstate pipeline companies down to 11.4. (See Appendix Table 3.) The 1971 interstate reserve data is preliminary.

We are now at the point where curtailments of both firm and interruptible gas service by the major pipeline companies are becoming increasingly prevalent with seriously adverse economic results - switching to more costly, less desirable fuels, and retarding effect on industrial growth in many parts of the Nation. Also, in many areas new gas service to private homes is being denied.

Pipeline companies are experiencing increasing difficulty in contracting for new gas supplies necessary to adequately serve present customers and provide service to all new consumers who are requesting it. Seven companies 1/ reported firm gas curtailments during the 1971-72 heating season. Reports from the companies involved indicate that total curtailments for this seven company group since November of 1970 exceeded 500 billion cubic feet.

Analysis of reports made to the Federal Power Commission by the pipeline companies this summer indicates that natural gas supply deficiencies for the year extending from April 1972 through March 1973 will be substantially more severe than for the prior year. Firm requirement deficiencies are forecast for 15 companies in the aggregate amount of approximately 1.0 trillion cubic feet for the 12 month period, April 1, 1972 to March 31, 1973. (See Appendix Tables 4 and 5.) This represents about 9.7 percent of the total annual sales (1970) of these

1/ Algonquin Gas Transmission Company, Arkansas Louisiana Gas Company, Panhandle Eastern Pipe Line Company, Texas Eastern Transmission Corporation, Transcontinental Gas Pipe Line Corporation, Trunkline Gas Company, and United Gas Pipe Line Company.

15 companies. The Gulf of Mexico outer continental shelf is a major supply area for many of these pipelines. A total of 27 interstate pipeline companies have filed gas curtailment plans with the FPC. The details are shown on Appendix Table 6.

In addition the interruptible gas service offered by many of the major pipeline companies is being much more frequently interrupted and for longer periods of time than in the past. One major pipeline company has announced that it plans to make no deliveries at all to its interruptible customers next winter.

The Commission's analysis of the current supply situation is set forth succinctly in Opinion No. 598. There the Commission stated:

"Curtailments in service to customers by pipeline and distributor companies are before us in a number of proceedings, ...An adequate gas supply is essential for efficient utilization of pipeline investment in transmission facilities to provide required service at a reasonable cost to the consumer. We thus find a critical shortage of gas in the United States."

The Future Requirements Committee 2/ has estimated that in 1975 only 86 percent of the anticipated national requirement for natural gas can be met from currently contracted or reasonably assured supplies.

2/ The Future Requirements Committee is sponsored by the Future Requirements Agency, Denver Research Institute, University of Denver and is composed of members from the gas producing, pipeline, and distribution industry, observers from state and Federal regulatory bodies, American Gas Association, American Petroleum Institute, Independent Natural Gas Association of America and the National Association of Regulatory Utility Commissioners.

An FPC Staff Report 3/ draws similar conclusions with respect to the supply-demand balance and additionally forecasts continuing and increasing supply difficulties to the year 1990. Staff reports an anticipated level of unsatisfied demand for gas of about 3.6 trillion cubic feet in 1975. The staff projected a widening supply shortfall in the period beyond 1975 and reported anticipated supply deficiencies of 9.5, 13.7 and 17.1 trillion cubic feet in 1980, 1985 and 1990 respectively.

The staff made estimates of reasonable levels of annual additions to domestic reserves and further estimated the annual rate of gas deliverability which could be expected from these reserves. The staff's projections in this case were based on a turnaround in the annual finding rate and a return to the average historical finding rate of the 1961-1970 period (17 trillion cubic feet annually) by 1976. The table below compares these projections of domestic production with the anticipated demand for gas:

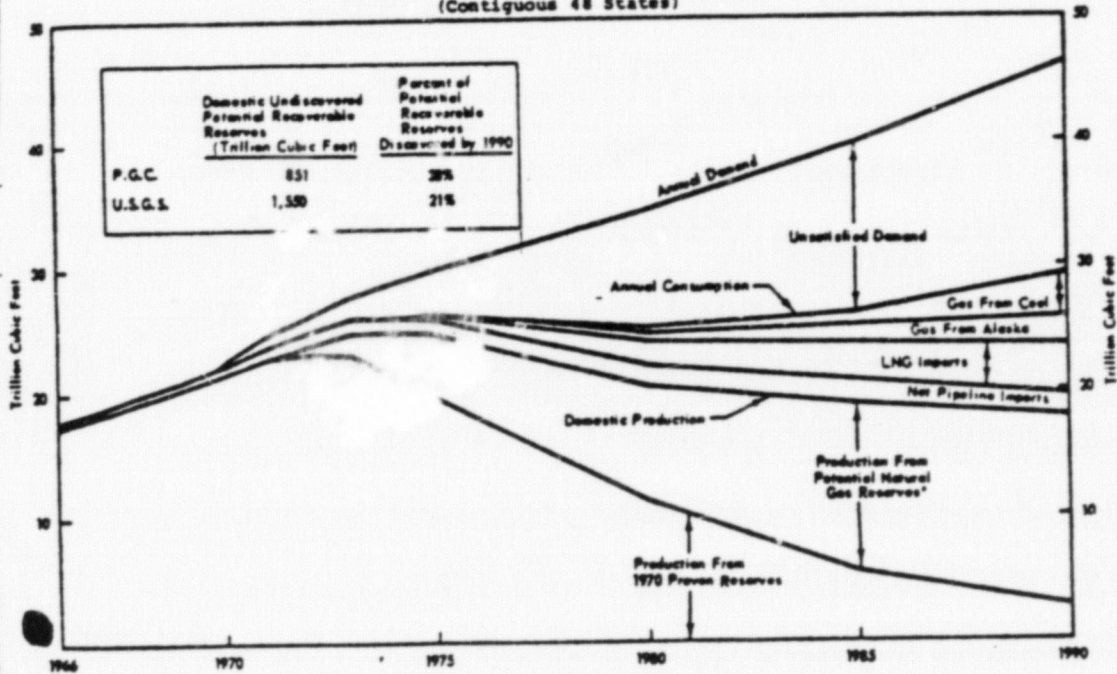
3/ National Gas Supply and Demand 1971-1990, Staff Report No. 2, prepared by the Commission's Bureau of Natural Gas, February 1972.

UNITED STATES INDIGENOUS SUPPLY vs. DEMAND
(Volumes in trillions of cubic feet)

<u>Year</u>	<u>Demand</u>	<u>Domestic Production</u>	<u>Domestic Supply Deficit</u>
1972	26.1	23.8	2.3
1973	27.7	24.7	3.0
1974	28.8	24.8	4.0
1975	29.8	24.7	5.1
1980	34.5	20.4	14.1
1985	39.8	18.5	21.3
1990	46.4	17.8	28.6

This gap between the projected demand for gas and a projection of domestic supply cannot be avoided, even at assumed annual rates of reserve additions of 20, 25, and 30 trillion cubic feet, with a domestic supply deficit developing by the mid-seventies and worsening over the time span considered by the staff. The following chart shows the developing supply-demand imbalance.

UNITED STATES GAS SUPPLY-DEMAND BALANCE
(Contiguous 48 States)



*U.S. Natural Gas Reserve Additions (1971-1990) Total 325 Trillion Cubic Feet.

Further evidence of the worsening domestic natural gas supply position is seen in increasing applications to the FPC to import gas and in other applications to synthesize natural gas substitutes from natural gas liquids or naphtha.

The Southern Louisiana area (including both onshore and offshore zones) has played a major role in determining the Nation's natural gas reserve-production position in the past, and is expected to take on increasing significance in the future. In 1956 this area contributed about 13 percent of the

gas produced domestically. By 1971 its contribution had increased to about 35 percent. Production during the period from 1956 through 1971 increased more than five fold. Reserves more than doubled during the same period to a peak of 83.4 trillion cubic feet in 1968 but have since declined to 75.0 trillion cubic feet in 1971. Even so, during the past four years more than half of the total U.S. reserve additions of the lower 48 states have been contributed by South Louisiana.

Fortunately, this Nation possess the natural gas resource potential to meet incremental demand. The Potential Gas Committee estimated that, as of January 1, 1971, the potential supply of natural gas in the United States, which remains to be found and developed in the lower 48 states, was 851 trillion cubic feet. The United States Geological Survey independently estimated potential supply at approximately 1,600 trillion cubic feet.

The latest estimate of potential natural gas supply by the Potential Gas Committee ^{4/} attributes 145 trillion cubic feet to South Louisiana as a whole, and 99 trillion cubic feet (or more than 68 percent) to the offshore area. The total offshore Louisiana potential comprises almost 12 percent of

^{4/} The Potential Gas Committee is sponsored by the Potential Gas Agency of the Colorado School of Mines and is composed of members from the transmission, distribution and production segments of the gas industry, along with members and observers from state and Federal agencies, Canada, Mexico and the National Association of Regulatory Utility Commissioners.

that estimated for the lower 48 states. These figures illustrate the degree to which the ability of the lower 48 states to meet the growing demand for natural gas depends on the development of Louisiana's offshore potential. The present state of development of offshore transportation facilities, with numerous pipelines already extending out into the Gulf waters, will shorten the time required to bring these resources to maturity.

In accordance with your announcement for this hearing, I will direct the remainder of my testimony to the Draft Environmental Statement.

The Bureau of Land Management has given what appears to be a balanced and reasonable assessment of the environmental risks associated with offshore oil and gas development. I will comment primarily on the statement dealing with alternatives to the proposed action.

I am mostly concerned that certain actions are characterized as alternatives to this lease sale. Most of the programs described in this chapter are not alternatives to expanded exploration and development of the Nation's undiscovered oil and gas potential. The term "alternative" implies the exercise of a deliberate choice between two or more courses of action.

The current national gas shortage is now at the point where we no longer have choices. We are confronted only by a single compelling imperative - to move forward promptly to develop all of our conventional and non-conventional gas supply possibilities, to the extent that their development serves the public interest.

Increased onshore gas exploration, for example, is not an alternative to increased offshore gas exploration. We require both. Increased LNG from overseas for example, is not an alternative to offshore gas exploration or to coal gasification. We must seek to develop all three. In fact, most of the programs listed in Chapter VIII, rather than constituting "alternatives", represent a reasonably comprehensive package of on-going energy programs which in their totality are urgently needed to meet the national energy problem. Even number 12, reduction in demand, is not an alternative in the sense that it involves a choice. A forced reduction in demand, due to gas curtailments, is now upon us. It is being experienced today by gas customers and potential gas customers throughout the country.

The South Louisiana offshore continental shelf represents one of the most attractive potential oil and gas provinces in the U. S. Its availability for exploration is essential to the success of the Federal Power Commission's efforts to provide adequate gas supplies. This proposed lease sale (plus the nine additional sales in Interior's five year program) is necessary if the Nation's gas resources are to be developed in a timely manner.

Without minimizing in any respect the importance of synthetic gas from coal, LNG imports, or nuclear fracturing of tight gas bearing reservoirs, the development of new conventional natural gas reserves, both onshore and offshore, must stand as the essential centerpiece of our strategy. It is the only one of the so-called "alternatives" that holds the promise of substantial, short term practical results.

The "alternatives" of Chapter VIII are a variety of essential on-going energy programs and various eventualities which have either already taken place or will likely occur soon, not necessarily through choice, but under the impetus of gas shortage necessity.

Needless to say, we would much prefer the proposed modified lease sale (23 oil prone tracts eliminated) to no sale at all. But this is a much less preferable second choice.

Natural gas is a clean-burning, sulfur-free fuel at the point of combustion. A commercially acceptable device for the removal of sulfur compounds from flue gas is not available, and to date, the best method of controlling emissions of sulfurous pollutants is to burn low-sulfur fuels. While there is hope that stack devices for the removal of sulfurous pollutants from the flue gases of electric generating plants and other large volume fuel burning equipment may become available in the years ahead, it does not appear promising that such a device will in the near future be developed for individual residential space heating applications. Residential use of coal and fuel oil for space heating results in significant sulfur oxide emissions. (See Appendix, Table 7.)

The availability of environmentally acceptable fuels for heating homes, cooking meals, and supplying energy for the manufacture of products and the generation of electricity certainly contributes to the preservation of man's environment.

Because of its clean burning characteristics, natural gas is a premium fuel in the battle to preserve and protect the quality of the air man breathes. Environmental concern requires broader application than just the local area surrounding the leases here under consideration.

Energy is the lifeblood of our economy and the catalyst enabling us to convert raw resources into the products and services that constitute our high standard of living. The growth of our National economy supporting our technologically advanced civilization is dependent on continued expansion of our energy resource base.

In acting to alleviate the growing shortage of natural gas and other fuels, appropriate consideration must be given to the environmental applications of such actions. Section 102(B) of NEPA requires that all Federal agencies give appropriate consideration to environmental as well as economic and technical factors in the decision-making process. It is necessary, therefore, that a balanced approach be followed which will achieve needed resource development while at the same time protecting the environment. One of the stated purposes of NEPA is to encourage productive and enjoyable harmony between man and his environment.

A narrow interpretation of the NEPA mandate will not achieve that balance and will not, therefore, serve the public interest. A multitude of environmental factors must be considered extending from the local areas where the resource development and production activities take place to the ultimate markets where the resource is consumed. I urge the panel to view in balanced perspective this proposed lease sale, and, having weighed the broad benefits which will accrue to the Nation's gas consumers, approve the sale. Thank you.

APPENDIX, Table 1

UNITED STATES NATURAL GAS SUPPLY EXCLUDING ALASKA*
1946-1971

(All Volumes in Trillions of Cubic Feet @ 14.73 Psia and 60°F.)

<u>Year</u>	<u>Net Production</u>	<u>Reserve Additions</u>	<u>Year-End Reserves</u>	<u>R/P Ratio (4) ÷ (2)</u>	<u>F/P Ratio (3) ÷ (2)</u>
(1)	(2)	(3)	(4)	(5)	(6)
1946	4.9	17.6	159.7	32.6	3.6
1947	5.6	10.9	165.0	29.5	1.9
1948	6.0	13.8	172.9	28.8	2.3
1949	6.2	12.6	179.4	28.9	2.0
1950	6.9	12.0	184.6	26.8	1.7
1951	7.9	16.0	192.8	24.4	2.0
1952	8.6	14.3	198.6	23.1	1.7
1953	9.2	20.3	210.3	22.9	2.2
1954	9.4	9.6	210.6	22.4	1.0
1955	10.1	21.9	222.5	22.0	2.2
1956	10.9	24.7	236.5	21.7	2.3
1957	11.4	20.0	245.2	21.5	1.8
1958	11.4	18.9	252.8	22.2	1.7
1959	12.4	20.6	261.2	21.1	1.7
1960	13.0	13.8	262.2	20.2	1.1
1961	13.4	16.4	265.4	19.8	1.2
1962	13.6	18.8	270.6	19.9	1.4
1963	14.5	18.1	274.5	18.9	1.2
1964	15.3	20.1	279.4	18.3	1.3
1965	16.3	21.2	284.5	17.5	1.3
1966	17.5	19.2	286.4	16.4	1.1
1967	18.4	21.1	289.3	15.7	1.1
1968	19.3	12.0	282.1	14.6	0.6
1969	20.6	8.3	269.9	13.1	0.4
1970	21.8	11.1	259.6	11.9	0.5
1971	21.9	9.4	247.4	11.3	0.4

*Data represents total U.S. natural gas supply prior to 1960.
Alaska's natural gas supply was not reported until 1960.
Source:

Appendix, Table 2

TOTAL EXPLORATORY WELLS DRILLED FOR HYDROCARBONS
(Footage Drilled in Thousands of Feet)

Year	Total* Wells	Footage	Average Depth	Oil Wells	Footage	Average Depth	Gas Wells	Footage	Average Depth	Dry Holes	Footage	Average Depth	Success- ful Wells (?)
1945	5,610	23,047	4,109	836	3,750	4,486	376	1,772	4,712	4,398	17,527	3,985	21.6
1946	5,759	22,318	3,874	762	3,455	4,534	375	1,832	4,885	4,622	17,052	3,689	19.7
1947	6,775	26,393	3,896	982	4,281	4,359	396	1,895	4,787	5,397	20,217	3,746	20.3
1948	8,012	32,751	4,087	1,098	4,883	4,447	365	2,306	6,319	6,550	25,562	3,903	18.3
1949	9,058	34,748	3,842	1,406	5,950	4,232	424	2,409	5,682	7,228	26,439	3,658	20.2
1950	10,306	40,175	3,898	1,583	6,862	4,335	431	2,356	5,466	8,292	30,957	3,733	19.5
1951	11,756	49,344	4,197	1,763	8,125	4,609	454	2,496	5,497	9,539	38,723	4,059	18.9
1952	12,425	55,615	4,476	1,776	8,491	4,781	559	3,394	6,071	10,090	43,731	4,334	18.8
1953	13,313	60,664	4,557	1,981	9,432	4,761	699	3,952	5,654	10,633	47,280	4,447	20.1
1954	13,100	59,601	4,550	1,985	9,409	4,740	726	4,399	6,059	10,389	45,792	4,408	20.7
1955	14,942	69,206	4,632	2,236	10,774	4,819	874	5,212	5,964	11,832	53,220	4,498	20.8
1956	16,207	74,337	4,587	2,267	11,111	4,901	822	5,179	6,301	13,118	58,047	4,425	19.1
1957	14,714	69,181	4,702	1,945	9,794	5,036	865	5,967	6,898	11,904	53,420	4,488	19.1
1958	13,199	61,484	4,658	1,745	8,712	4,993	822	5,472	6,657	10,632	47,300	4,449	19.4
1959	13,191	63,253	4,795	1,702	8,545	5,021	912	6,031	6,613	10,577	48,676	4,602	19.8
1960	11,704	55,831	4,770	1,321	6,829	5,170	868	5,466	6,298	9,515	43,535	4,575	18.7
1961	10,992	54,442	4,953	1,157	5,900	5,099	813	5,249	6,457	9,022	43,293	4,799	17.9
1962	10,797	53,616	4,966	1,211	6,205	5,124	771	5,187	6,728	8,815	42,223	4,790	18.4
1963	10,664	53,485	5,015	1,314	6,409	4,877	664	4,230	6,370	8,686	42,847	4,933	18.5
1964	10,747	55,497	5,164	1,219	6,715	5,509	577	4,204	7,285	8,951	44,578	4,980	16.7
1965	9,466	49,204	5,198	946	5,366	5,672	515	3,757	7,295	8,005	40,081	5,007	15.4
1966	10,313	55,223	5,355	1,030	5,880	5,708	578	4,881	8,445	8,705	44,462	5,108	15.6
1967	9,059	49,124	5,423	1,039	5,990	5,765	556	4,231	7,609	7,464	38,903	5,212	17.6
1968	8,879	50,938	5,739	863	5,036	5,835	430	3,320	7,720	7,586	42,603	5,616	14.6
1969	9,701	57,400	5,924	1,084	6,363	6,054	616	4,985	8,092	8,001	45,918	5,739	17.5
1970	7,693	45,253	5,882	790	5,055	6,399	481	3,675	7,639	6,422	36,524	5,687	16.5
1971	6,922	40,388	5,835	651	3,712	5,701	437	3,328	7,616	5,834	33,347	5,736	15.7

Source: AAPG

* Includes Alaska. Excludes stratigraphic and core tests.

APPENDIX, Table 3

INTERSTATE GAS RESERVES AND PRODUCTION
1963-1971

(All Volumes in Trillions of Cubic Feet @ 14.73 Psia and 60°F.)

<u>Year</u> (1)	<u>Annual Production</u> (2)	<u>Year-end Reserves</u> (3)	<u>R/P Ratio (3) ÷ (2)</u> (4)
1963	9.4	188.5	20.2
1964	10.0	189.2	18.9
1965	10.4	192.1	18.5
1966	11.1	195.1	17.5
1967	11.8	198.1	16.8
1968	12.6	195.0	15.5
1969	13.4	187.6	14.0
1970	14.1	173.6	12.3
1971(p)	14.2	161.3	11.4

(p) Preliminary Data

Source: Federal Power Commission Form 15 Reports

PROJECTED FIRM REQUIREMENT DEFICIENCIES REPORTED BY
PIPELINE COMPANIES TO THE FEDERAL POWER COMMISSION STAFF

<u>COMPANY</u>	<u>Projected Firm Deficiencies in Millions of Cubic Feet</u>		
	<u>April - October 1972</u>	<u>Nov. 1972- March 1973</u>	<u>12 Months</u>
Algonquin Gas Transmission Company <u>1/</u>	7,321	6,162	13,483
Arkansas Louisiana Gas Company	83,462	65,631	149,093
Cities Service Gas Company	5,000	23,000	28,000
Colorado Interstate Gas Company	-0-	1,800	1,800
Consolidated Natural Gas Company	23,853	-0-	23,853
Eastern-Shore Natural Gas Company	-0-	0,083	0,083
El Paso Natural Gas Company	-0-	33,120	33,120
Mississippi River Transmission Corp. <u>2/</u>	-0-	2,135	2,135
Natural Gas Pipeline Company of America	149,800	-0-	149,800
Northern Natural Gas Company	6,262	-0-	6,262
Panhandle Eastern Pipe Line Company	3,500	22,000	25,500
Texas Eastern Transmission Corp.	46,164	44,746	90,910
Transcontinental Gas Pipe Line Corp. <u>2/</u>	46,407	48,514	94,921
Trunkline Gas Company	39,885	57,714	97,599
United Gas Pipe Line Company	221,276	27,094	348,370
TOTAL	632,930	431,999	1,064,929

NOTES:

1/ Staff calculation of maximum possible from submitted data.

2/ Revised June 1972.

Appendix, Table 5

PERCENTAGE OF 12 MONTH PROJECTED FIRM REQUIREMENT DEFICIENCIES

(1972-73) TO TOTAL 1970 GAS SALES

<u>COMPANY</u>	<u>12 MONTH FIRM DEFICIENCY FROM TABLE I (MMcf)</u>	<u>TOTAL 1970 SALES (MMcf)</u>	<u>PERCENT DEFICIENCY/ 1970 SALES</u>
Arkansas Louisiana Gas Co.	149,093	454,368	32.8
United Gas Pipe Line Co.	348,370	1,496,177	23.3
Trunkline Gas Co.	97,599	499,374	19.5
Natural Gas Pipeline Co. of America	149,800	1,107,554	13.5
Algonquin Gas Transmission Co.	13,483	139,339	9.7
Transcontinental Gas Pipe Line Corp.	94,921	998,146	9.5
Texas Eastern Transmission Corp.	90,910	996,789	9.1
Cities Service Gas Co.	28,000	521,824	5.4
Panhandle Eastern Pipe Line Co.	25,500	748,142	3.4
Consolidated Natural Gas Co.	23,853	809,788	2.9
El Paso Natural Gas Co.	33,120	1,731,871	1.9
Eastern Shore Natural Gas Co.	83	8,163	1.0
Mississippi River Transmission Corp.	2,135	247,165	0.9
Northern Natural Gas Co.	6,262	873,693	0.7
Colorado Interstate Gas Co.	1,800	383,573	0.5
	<u>1,064,929</u>	<u>11,015,966</u>	<u>9.7</u>

Appendix, Table 6, Sheet 1

<u>DOCKET NO.</u>	<u>APPLICANT</u>	<u>CURTAILMENTS FILED WITH THE COMMISSION</u> <u>TYPE-(End Use Listing From</u> <u>Lowest to Highest Priority)</u>
RP70-42	Natural	Voluntary relinquishment by larger customers-Ratable after voluntary cut-backs
RP71-29 and RP71-120	United Gas	End Use-(1)Industrial including resale and pipeline (2) Electric generation consumed by domestic customers (3) Process gas (4) Residential and Commercial
RP71-100	Trunkline	Ratable-
RP71-107	Northern	End Use-(Winter)-(1)Interruptible electric generation load (2) Large volume interruptible industrial Ratable-(Summer)-Up to 15% of C.D. than winter curtailment.
RP71-116	Granite State	Ratable-However, residential and commercial customers have preference.
RP71-117	Micro-Wisc	Ratable-However, seller may require buyer to curtail interruptible loads of 200 Mcf per day.
RP71-118	Transco	End Use-All interruptible sales first and then pro rata curtailment across-the-board of large volume sales.
RP71-119	Panhandle	End Use-based on industrial usage regardless if deliveries are firm or interruptible. Human needs are exempt (hospitals, schools, apartments, etc.)

CURTAILMENTS (continued)

RP71-121 and RP72-21	Eastern Shore	End Use-(1) All interruptible sales (2) Firm direct and resale industrial (3) Residential and Commercial
RP71-122	Ark-La	End Use-(1) Interruptible sales (2) Large industrial where alternate fuels can be used (3) Large industrial where alternate fuels can't be used (4) Small Industrial & Commercial (5) Residential & Commercial
RP71-127 and RP72-47	Con Gas	End Use-(1) Large Industrial (2) Small Industrial (3) Domestic and Commercial Customers
RP71-128	Florida Gas	End Use-(1) Curtailment of four classes of interruptible (2) If seller can't meet firm requirements, then curtailments are ratable.
RP71-129	Cities	End Use-(1) Electric generation sales under LVS Rate Schedule (2) All direct & resale industrial interruptible
RP71-130	Texas Eastern	Ratable-
RP71-131	Algonquin	Ratable-
RP71-134	Great Lakes	Ratable-
RP71-135	Colorado Interstate	End Use-(1) Interruptible to direct and resale customers (2) Firm service to resale customers for interruptible industrial use (3) Firm direct or resale industrial use (4) Firm domestic and Commercial use

CURTAILMENTS (continued)

RP71-138	Alabama-Tenn	Ratable-However, all interruptible sales will be curtailed first.
RP71-139	Mid-Louisiana	End Use-(1)Interruptible customers (2) Industrial usage (3) Domestic Consumption
RP71-141	Shenandoah	End Use-Domestic customers have highest priority.
RP72-6	El Paso - So. Div.	End Use-(1)Direct industrial under contracts which provides for a subordinate priority (2) Direct and resale industrial (3) Commercial Customers (4) Domestic and Residential Customers.
RP72-13	Louisiana- Nevada	End Use-(1)Interruptible industrials and overrun (2)Firm industrials and sales for resale-Curtailed ratably with preference given to domestic customers.
RP72-15	Lone Star	End Use-(1)Oil Field Rate Sales(2)Direct Rate Interruptible Sales (3) Residential & Commercial Service.
RP72-04	Texas Gas	Ratable-
RP72-74	Southern Natural	End Use-Curtail initially those uses which represent the poorest utilization of gas and which are best suited to obtaining and utilizing alternate fuels.
RP72-89	Columbia Gas	Ratable-However, residential and commercial customers have preference.

- 4 -

CURTAILMENTS (continued)

RP72-99	Transco	Ratable-All interruptible sales first and then pro rata curtailment across-the-board of large volume sales.
RP72-94	Bluefield Gas	End Use-Domestic customers have highest priority.
RP72-122	Colorado Interstate	End Use-(1)Interruptible deliveries under EX-1 and S-1 (2) Firm Deliveries for resale to interruptible customers and firm interruptible deliveries to non-jurisdictional customers for industrial use (3) Storage (4) Domestic and Commercial.
RP73-6	Mississippi River	End Use-First 3 steps of curtailment relate to interruptible sales, next 2 steps relate to firm industrial sales and final steps cover remaining resale service.

Appendix, Table 7

COMPARISON OF COMBUSTION EMISSIONS
IN DOMESTIC APPLICATIONS

(lbs. of pollutant/150 million Btu)

	Coal (a) (6 tons)	Oil (b) (1,110 gal.)	Gas (c) (150,000 c.f.)
Oxides of Sulfur	225	117	0.06
Carbon Monoxide	300	2	0.06
Oxides of Nitrogen	48	13	17.4
Particulates	120 to 300	8.9	2.85

(a) 1.0% sulfur and 10% ash by weight.

(b) 1.0% sulfur by weight; heating value -- 135,000 Btu/gal.

(c) Heating value -- 1,000 Btu/c.f.

FEDERAL POWER COMMISSION STAFF COMMENTS ON
POSSIBLE SALE OF OIL AND GAS LEASES IN THE
NORTH ATLANTIC AREA

Appendix B

June 5, 1975

(1) The Potential Gas Reserves of the North Atlantic Area

The Staff of the Federal Power Commission does not collect data with regard to geologic structures in potential leasing areas. It is limited to consideration of geologic and actual reserves data provided during certification procedures relating to natural gas sales or construction of facilities to be used for the sale of natural gas for resale in interstate commerce. Therefore, the FPC has access to geologic and reserves data in areas already leased, and explored to the extent that the availability of production sufficient for sale has already been determined.

In the realm of natural gas potential of offshore areas, the FPC staff has for some time utilized the estimates of the Potential Gas Committee (PGC) 1/ as reasonable projections

1/ The Potential Gas Committee is sponsored by the Potential Gas Agency, Mineral Resources Institute, Colorado School of Mines Foundation, Inc., Golden, Colorado, and is composed of members from the gas producing, pipeline and distribution industry, from state geological surveys, the United States Geological Survey and from the geological faculties of universities. Membership also includes representatives from Canada and Mexico and observers from the Federal Power Commission, Federal Energy Administration, and the National Association of Regulatory Utility Commissioners. See enclosed map of the Potential Gas Committee publication Areas.



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

IN REPLY REFER TO:

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Mr. John W. Nassikas
Chairman, Federal Power Commission
825 N. Capitol Street
Washington, D.C. 20426

APR 14 1975

Dear Mr. Nassikas:

The Bureau of Land Management is commencing evaluation of a possible oil and gas lease sale in the North Atlantic in line with current policy for increased leasing on the Outer Continental Shelf (OCS) to help in meeting the President's energy self-sufficiency goal. This evaluation covers those areas indicated on the attached map.

Regulations cited in 43 CFR 3301.2 provide that reports from other agencies shall be requested which describe, to the extent known, other valuable resources contained within the general area and the potential effect of any mineral operations upon the resources or upon the total environment.

In keeping with these regulations, we would especially appreciate your comments on (1) the potential gas reserves of the North Atlantic area; (2) the need for gas from this area; (3) the probable markets for any gas, (4) the need to build pipelines; (5) the environmental impact which may result from developing these resources; and (6) the availability of capital and manpower to explore for and develop the resource.

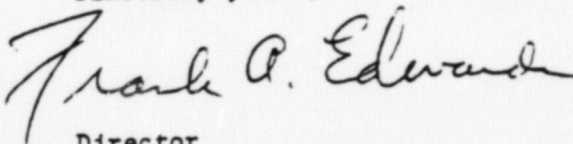
When a call for nominations is issued, we will comply strictly with the National Environmental Policy Act and the Council on Environmental Quality's implementing guidelines prior to any decision to proceed with a lease sale. If it is decided to proceed further with analyzing the possibilities of a sale, you will have additional opportunities to submit comments and recommendations during the course of the preparation of draft and final environmental impact statements and the holding of a public hearing.



Save Energy and You Save America!

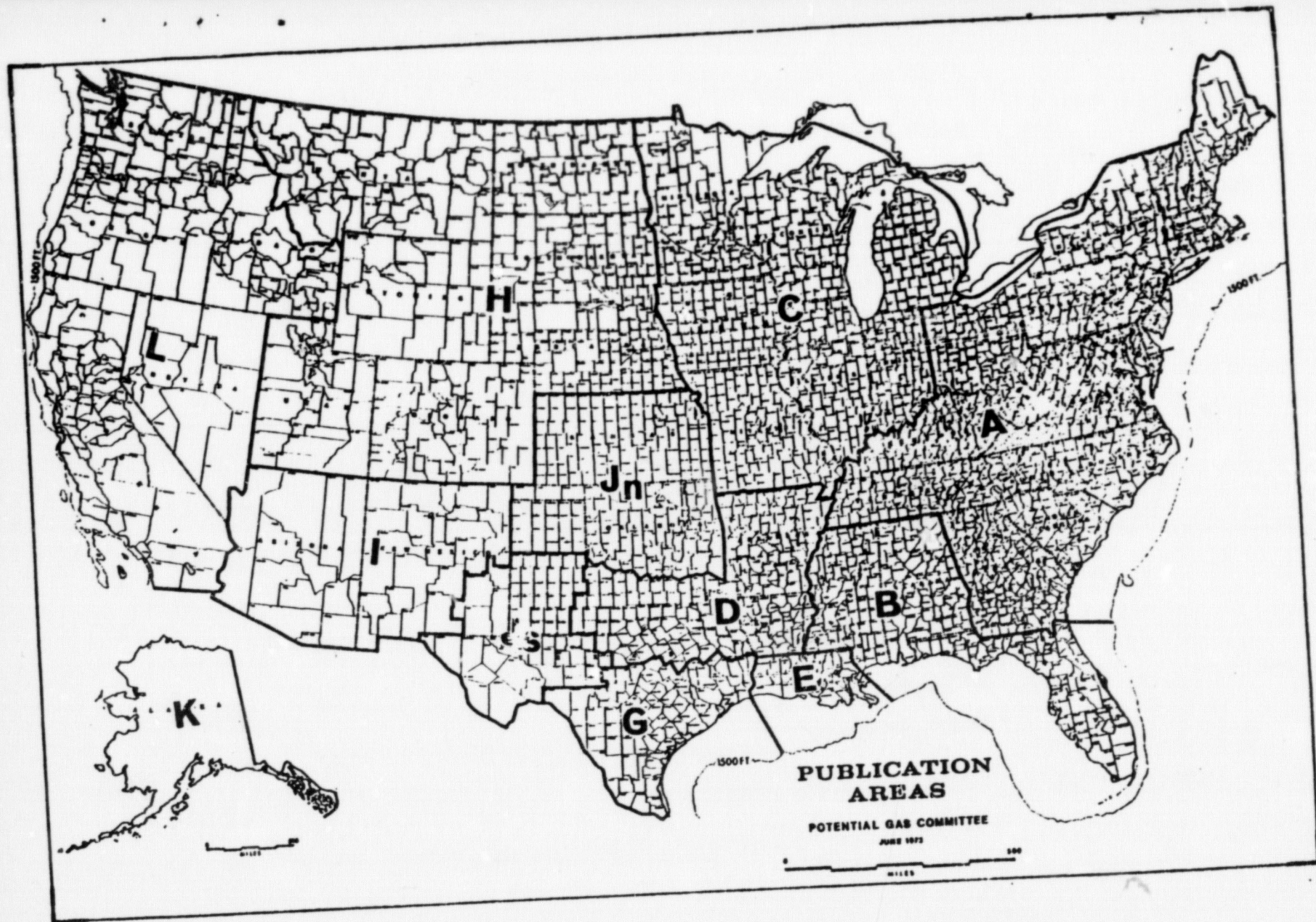
We would appreciate having your comments in duplicate submitted to the Director, Bureau of Land Management (Attention: 720) by June 16, 1975. For further information, please contact Mr. Dale Johnson, Chief, Branch of Marine Mineral Leasing, Division of Minerals Resources, telephone 343-8537.

Sincerely yours,

A handwritten signature in cursive script that reads "Frank A. Edwards". The signature is written in dark ink and is positioned above the typed name.

Assistant Director

Enclosure



of the volumes which may actually be recoverable in the future from these areas. The "potential supply" of natural gas as used by the PGC is defined as the prospective quantity of natural gas yet to be found and proved by all wells which may be drilled in the future under assumed conditions of adequate but reasonable prices and normal improvement in technology. "Probable" supplies are the most assured of new supplies, resulting from the growth of existing fields. "Possible" supplies are less assured supplies, resulting from new field discoveries in formations previously productive; such new fields would be distinctly separated from existing fields. "Speculative" supplies are the most nebulous of new supplies, and result from new pool or new field discoveries in formations or provinces not previously productive.

According to the Potential Gas Committee, the undiscovered potential of the entire Atlantic offshore area is about 35 trillion cubic feet.^{2/} This represents about 9 percent

^{2/} The Potential Gas Committee estimate is for the entire Atlantic Coast down to the Florida border. Florida potential supply in the Atlantic is included in the PGC estimate for Mississippi, Alabama and Florida offshore potential which includes the Gulf of Mexico waters off the coasts of these states.

of the undiscovered potential of the total United States offshore area and is about 4.5 percent of the total undiscovered potential of the lower 48 states. Thirty of the 35 trillion cubic feet estimated for the offshore area are assigned to water depths of 600 feet or less. All of the potential reserves are classified in the speculative category. It is not known what portion of these reserves would be assignable to the North Atlantic area (including the Georges Bank Basin) here under consideration. These potential reserves might become economically recoverable reserves given sufficient exploration and development effort. If the geological prospects in the area of the possible sale appear to be of sufficient quantity and quality, there should be both economic incentive and available capital to develop the resources.

The U.S. Geological Survey also makes estimates of domestic oil and gas resources. The terminology used by the USGS to define undiscovered resources is different from that used by the PGC. However, a rough correlation can be made for major geographical areas. Regrettably, the USGS does not make separate estimates of potential resources for the offshore Atlantic on a subarea basis. Their estimate of

indicated-inferred reserves plus undiscovered recoverable resources, which taken together would constitute potential supply, total to a range of 55-110 trillion cubic feet for the total Atlantic offshore area. 2/ The USGS water depth limitation for undiscovered recoverable resources is 200 meters (656 feet) in contrast to the PGC estimate of offshore potential supply which includes water depths to 1,500 feet.

(2) The Need for the Gas from the Atlantic Offshore Area

The need for accelerated development of our Outer Continental Shelf areas becomes more apparent each year as the demand for environmentally acceptable fuels continues to increase, while natural gas reserves continue to decline due to the low level of reserve additions in the contiguous 48 states. In fact, reserve additions in the "lower 48" have not exceeded production since 1967. In that year, offshore reserve additions were approximately 20 percent of total reserve additions for the contiguous states. Since that time, offshore reserves have become increasingly important, and new reserve additions in the Gulf of Mexico alone, as reported by the A.G.A., have accounted for 36 percent of the total "lower 48" reserve additions over the last three years.

3/ New USGS estimates now being finalized will substantially reduce these figures.

Unfortunately, new reserves from the offshore areas have been unable to fill the gap created by the low level of onshore reserve additions. During the past seven years, total U.S. reserve additions in the contiguous states have been less than half of production, and the proven reserve inventory has shrunk to 205.3 trillion cubic feet, 84 trillion cubic feet below its 1967 high-point of 289.3 trillion cubic feet. The reserve/production (R/P) ratio which stood at 15.7 at the end of 1967 had dropped to 9.7 by the end of 1974. ^{4/}

The trends in interstate gas supply are similar to those of the total supply for the lower 48 states. In 1974, interstate reserves, as reported by the interstate pipeline companies in Federal Power Commission Form 15, declined for the seventh consecutive year to a year-end level of about 120 trillion cubic feet. ^{5/} The 1974 decline was about 14.3 trillion cubic feet and brought the interstate pipeline company R/P ratio down to 9.4. This decline in the interstate supply has manifested itself in firm service curtailments during the past several years beginning in November 1970. These curtailments have increased from 17.5 billion cubic feet in 1970 to 1,679 billion cubic feet during 1974.

^{4/} American Gas Association, Reserves of Crude Oil, Natural Gas Liquids and Natural Gas in the United States and Canada and United States Productive Capacity as of December 31, 1974, June 1975.

^{5/} Preliminary data.

These firm requirement deficiencies amounted to about 8 percent of production in 1974, and will probably total over 10 percent of production in 1975. However, these statistics do not tell the entire story since additional gas would have been consumed during the past several years if the supply had been available. Many gas companies are limiting the attachment of new customers, either under their own initiative or under the direction of state regulatory bodies. Demand continues to increase while in 1974 natural gas production actually decreased. Supplemental sources of gas such as LNG imports, synthetic gas from liquid petroleum feedstocks and coal, and gas from Alaska will help to fill the ever increasing gap between supply and demand. However, these supplemental sources require substantial lead time to develop and probably will not make a significant impact before 1980.

The Future Requirements Committee 6/ has estimated that in 1975 only 86 percent of the anticipated national demand

6/ The Future Requirements Committee is sponsored by the Future Requirements Agency, Denver Research Institute, University of Denver, and is composed of members from the gas producing, pipeline and distribution industry, observers from state and Federal regulatory bodies, American Gas Association, American Petroleum Institute, Independent Natural Gas Association of America and the National Association of Regulatory Utility Commissioners.

for natural gas will be met from currently contracted or reasonably assured supplies. The Staff of the Federal Power Commission draws similar conclusions with respect to the supply-demand balance, and additionally forecasts continuing and increasing supply deficiencies to 1990. The magnitude of any future supply-demand imbalance will depend upon the market demand for gas in competition with other energy sources, the rate of development of alternate gas supplies, and to a considerable degree, the frequency and size of offshore lease sales. The early determination of whether our offshore areas contain large quantities of commercially exploitable hydrocarbons is vital to our overall energy planning and policies.

(3) The Probable Markets that North Atlantic Offshore Natural Gas Production Would Serve

It appears most likely that any natural gas supplies produced from the proposed leasing area would be transported onshore in the approximate vicinity of the producing area. There are a number of interstate and intrastate pipelines throughout the onshore area but they are primarily dependent on gas delivered by major long-haul pipeline suppliers.

These suppliers purchase gas produced in the Southwest, principally, but not exclusively, in Louisiana and Texas, including the Gulf Coast offshore area.

These long-haul pipelines delivering gas to the Eastern Seaboard are:

- (a) Columbia Gas Transmission Corporation
- (b) Tennessee Gas Pipeline Company
- (c) Texas Eastern Transmission Corporation
- (d) Transcontinental Gas Pipe Line Corporation

Natural gas curtailments are particularly noticeable on the Eastern Seaboard because of the deteriorating supply postures of these major long-haul pipe lines. These four pipelines have projected system-wide firm curtailments for the year September 1974 through August 1975 of 14.8, 7.6, 22.8 and 27.8 percent, respectively. 7/ Natural gas

7/ "Requirements and Curtailments of Major Interstate Pipeline Companies Based on Form 16 Reports Required to be Filed on September 30, 1974," Federal Power Commission, Bureau of Natural Gas, Staff Report, November 1974. FPC News Release No. 20849, November 15, 1974.

delivered to consumers in the states approximately adjacent to the proposed leasing area was about 1,230 billion cubic feet in 1973. 8/ 9/ In addition, significant successful development of the Atlantic Offshore area would not only help to fill the gap between supply and requirements in the immediate area, but would also add valuable supply increments to the interstate pipeline systems serving the entire East Coast.

There is another aspect of the energy shortage in the Eastern Seaboard states and particularly in New England. This relates to the heavy dependence of the East Coast on, and shortage of, imported oil and oil products, especially for the generation of electricity. In addition, because of the heavy dependence on imports, the price paid on the upper East Coast for heating and fuel oil supplies has increased drastically.

8/ United States Department of Interior, Bureau of Mines, "Natural Gas Production and Consumption, 1973."

9/ New Jersey, New York, Connecticut, Rhode Island, Massachusetts, Vermont and Maine.

4) The Need to Build New Pipelines

In order to attach any new gas supplies discovered in the area of the possible sale, new offshore and onshore pipeline construction will be required. The actual miles of pipeline and number of compressor stations depends on the volume of gas supply, its location, and the ability of any existing onshore pipeline facilities to transport increased volumes.

Because this is a virgin area, there is, of course, no offshore gas pipeline network in existence. However, if the development of the leases included in the currently proposed offshore oil and gas lease sale, together with those of the Mid-Atlantic sale now tentatively scheduled for early 1976, is successful in proving new gas supply, the construction of a pipeline system will be required. The utilization of this system could greatly reduce additional pipeline requirements resulting from subsequent discoveries on acreage to be included in future lease sales.

As to additional onshore pipeline facilities, this will depend upon which pipelines attach the gas and whether their systems are being fully utilized. To the extent that

East Coast interstate pipelines supplied from this area will be curtailing deliveries, there should be spare onshore pipeline capacity to deliver part, if not all, of the new supplies resulting from the development of the leases in the proposed sale.

(5) The Environmental Impact Which May Result from Developing These Resources

The Federal Power Commission has not been delegated by law the responsibility for inventorying coastal zone features, hazards, and resources; it therefore defers comment on the environmental impact of leasing and subsequent development of Outer Continental Shelf lands to other Federal and state agencies and organizations. The Commission is responsible and has been given legal authority, however, for certificating interstate natural gas pipelines. In addition there are specific actions which the Commission can and does take to reduce or eliminate potential impacts of these facilities on the coastal zone environment at such time as certification is requested by specific application to the Commission.

The coastal zone contains many critical environmental elements, such as beaches, estuaries, and marshes. The Commission has a mandate under NEPA and the Coastal Zone Management Act to protect these critical areas. Poorly planned pipeline construction can degrade these environments, and create land-use conflicts. The effects of natural gas pipeline construction and operation, however, can be substantially reduced by careful planning, utilization of appropriate construction techniques, and further development of enlightened

coastal zone management policies. Interagency cooperation in the establishment of multiple-use pipeline corridors is an example of an effective way to mitigate environmental impacts. There are few significant environmental problems relevant to natural gas pipelines that cannot be solved by good advanced planning and by the application of sound technical, regulatory, and management techniques. Steps to assure greater cooperation and advanced planning are two specific actions that will reduce potential conflicts between environmental protection and oil and gas exploration and development activities.

Three detailed publications are particularly pertinent to the task of identifying potential environmental impacts from sale and subsequent development of offshore leases:

1. Outer Continental Shelf Oil and Gas - An Environmental Assessment, compiled under the direction of the Council on Environmental Quality and published in April 1974, would be an excellent reference in the preparation of, if not constitute the EIS.
2. Energy Under the Oceans - A Technology Assessment of Outer Continental Shelf Oil and Gas Operations, published by the University of Oklahoma Press, additionally details the broad environmental implications of offshore oil and gas developments.
3. Ecological Effects of Offshore Construction - 1972, published by the Marine Science Institute of Alabama, evaluates current knowledge of the probable ecological effects of various offshore construction activities.

(5) The Availability of Capital and Manpower to Explore
for and Develop the Resource

The availability of capital to explore and develop offshore gas resources will depend on economic incentives, available prospects and alternative investment opportunities to gas producers. The Federal Power Commission has established a wellhead price for new gas of 50 cents per thousand cubic feet. 10/ This rate applies to jurisdictional sales of natural gas from wells commenced on or after January 1, 1973, and new dedications of natural gas to interstate commerce on or after that date. The base rate, with annual escalations of 1.0 cent per Mcf, is subject to Btu adjustment plus reimbursement for production, severance, or similar taxes, and gathering allowances, including the onshore delivery of offshore gas at the cost of the producer. The Commission has also provided for a biennial review of the new gas ceiling price and for special relief from the national rate. The

10/ Federal Power Commission Opinion No. 699-H, Docket No. R-389-B, "Just and Reasonable National Rates For Sales of Natural Gas From Wells Commenced on or After January 1, 1973, and New Dedications of Natural Gas to Interstate Commerce on or After January 1, 1973," Issued December 4, 1974.

Commission has also established an optional procedure for certificating new sales under which it may authorize sales at rates above existing area rate ceilings if such rate is shown to be required by the public convenience and necessity.

A recent study the the Senate Commerce Committee 11/ projects that the available U.S. fleet of mobile drilling rigs capable of drilling in over 100 feet of water will number 70 in 1976 and will more than double to 148 by 1980. Some of these rigs could undoubtedly be utilized in the offshore Atlantic. Several thousand men will be required to staff these new rigs. Some contractors are already experiencing difficulties in staffing new rigs, and are trying such innovations as one-the-job training on existing rigs of crews for rigs still under construction, and the hiring of students for summer training in an effort to

11/ U.S. Congress, Senate Committee on Commerce, "An Analysis of the Department of the Interior's Proposed Acceleration of development of Oil and Gas on the Outer Continental Shelf," National Ocean Policy Study, March 1975, p.32.

get them to return after completion of education. The availability of experienced manpower could become a constraint to the rapid development of our offshore resources unless such programs are instituted to train new personnel as new rigs are completed. If the development of our deepwater offshore resources is highly successful, trained personnel for the installation of subsea production facilities and deepwater pipelines could also be in short supply. While the availability of the manpower required to develop our offshore areas in an orderly and efficient manner could be a problem for the short term, it is perhaps one of the most manageable problems in the long-term development of our offshore resources.

STATEMENT OF
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FEDERAL POWER COMMISSION

HEARINGS BEFORE THE
SUBCOMMITTEE ON ENERGY AND POWER
OF THE
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE
U.S. HOUSE OF REPRESENTATIVES

MARCH 24, 1977

THE LONG TERM PROSPECTS FOR CONVENTIONAL U. S. GAS SUPPLY

INTRODUCTION

There were two major energy events that took place in 1973. The contrast between these two events is interesting and says much about our national perception of serious energy problems. The first event, the OPEC oil embargo, followed by the new tough OPEC bargaining posture and skyrocketing world oil prices was given extensive press coverage and, of course, the temporary gasoline shortage had a direct impact on the lives of most citizens. By contrast, the second major energy event in 1973 received little, if any, media coverage. This second event was the peaking of U.S. natural gas production and the beginning of its decline for the first time in the history of the modern gas industry. It is generally agreed that the peaking of U.S. gas production, together with the peaking of U.S. crude oil production only three years earlier, holds at least as much significance for the future

of our nation as the dramatic events of the OPEC oil embargo which captured the headlines of the daily press and that these are two of the important elements in our current energy dilemma.

Changes have always taken place in our energy economy as new fuel forms have found acceptance and older fuel forms have declined and as technology has opened up new markets for energy and improved the extraction, processing and distribution of energy. Until very recently the dominant theme of the energy economy has been continuous growth. During the 50 years preceeding 1970, total energy use in the U.S. increased by a factor of three and one-half. During the most recent 20 years, growth has been at an average annual rate of about 3 percent for total energy and almost 5 percent for natural gas. Until very recently it has been a basic assumption of our society that ample supplies of cheap energy would be available to power new products or services and to carry out man's new and expanding activities.

Today we know that this is not true. Total U.S. energy use declined 4.9 percent from 1973 to 1975, the first successive two year drop since 1945 and 1946. Preliminary data indicate, however, that energy consumption increased by about 4.8 percent in 1976. Prices have soared for most energy forms and we are increasingly dependent on imports of crude oil. Domestic natural gas production has sharply declined for three successive years with dimming prospects for an upturn. As a result, we are faced with a serious gas shortage. Curtailments of firm gas

service have reached more than 3.8 Tcf per year. Since 1967, the lower 48 states proved reserve inventory has shrunk by more than one-third and reserve additions during this period have been less than one-half the amount necessary to maintain a constant level of proved reserves.

Our energy problem in general and the shortage of natural gas in particular has been a source of surprise, shock and disbelief to most of those affected, but not to many students of long term United States resource development. Resource specialists have seen the gas and petroleum shortages coming for at least 25 years and, in fact, have predicted the timing and impact of the natural gas shortage with remarkable accuracy. In 1948 the Federal Power Commission concluded a comprehensive investigation of the gas industry (Docket No. G-580). In their report of this investigation Commissioners Leland Olds and Claude L. Draper gave this assessment of future gas supply:

"The importance of giving the most serious consideration to all aspects of the problem of conserving natural gas is based squarely on the fact that it is a limited and exhaustible resource. Whatever estimates are accepted for the ultimate total of the country's natural gas reserves in relation to ultimate market requirements, it can be asserted without fear of contradiction that at some time in the reasonably near future the deliverability of natural gas is going to begin to decline toward the day when it will no longer be counted among the country's important fuel resources." 1

A warning similar to that contained in the Olds-Draper report was issued four years later in June 1952 by the President's Material Policy Commission (Paley Commission) which said:

"Some thought must now be given to the prospect of ultimate exhaustion of natural gas resources in guiding the present development of the industry, as well as to the encouragement of research on the economical production of substitutes from coal or of research into other energy sources such as solar energy to replace gas when the time comes....

"At some point beyond 1975, however, more serious problems are likely to arise when natural gas supplies will eventually have shrunk to the point that the general uses in gas producing areas and special uses in all areas are forced to shift to substitute fuels." 2

An interesting aspect of both the Olds-Draper report in 1948 and the Paley Commission report in 1952 is that they each forecast the current gas shortage as an inevitable future event long before the FPC started to regulate the wellhead price of natural gas following the Phillips decision of the Supreme Court in 1954.

The question may well be asked then, why Federal policymakers and gas industry leaders did not take steps to curb the expansion of gas markets and the Nation's

dependency on natural gas. From the AGA reserve addition data shown on Table 1 it can be seen that in each year prior to 1968 reserve additions exceeded production, and as a result, the total U.S. proved gas reserve inventory increased each year. This fact was frequently cited when questions were raised about the prospects for long term U.S. gas supply. There was no cause for alarm, it was thought, as long as annual reserve additions exceeded production withdrawals.

It now appears that there were other important factors which should have been examined more closely. One of these factors was that a fairly high level of reserve additions can be maintained for a long time through continued development of previously discovered fields. For example, ultimately recoverable reserves relating to discoveries made prior to 1967 increased 47 Tcf from the end of 1966 through 1975. Excluding the Prudhoe Bay field, these additions accounted for about one-half of the new reserves added during this period. About 5 Tcf of the reserves added to the reserve inventory resulted from upward revisions to reserves discovered in 1922 and prior years.

THE IMPORTANCE OF LARGE FIELDS

The natural gas industry depends primarily upon the

production of gas from a relatively few large fields. Of the more than 6,000 gas producing fields in the U.S., approximately 100 large fields, or less than 2 percent of the total, contain over 50 percent of the domestic gas reserves and provide a substantial portion of the gas production.

The fact that the natural gas industry relies so heavily on a few large fields is not a problem in itself. The difficulty arises from the fact that the majority of the large fields are old fields. As an example, out of the 15 largest interstate fields which contain almost 30 percent of the interstate reserves, 11 were discovered prior to 1960 with the remaining 4 being discovered between 1960 and 1963. Four out of the 5 largest were discovered prior to 1940, with the largest being discovered in 1922. These large fields through the years have provided much of the deliverability of natural gas for both the interstate pipeline systems and the total industry.

An analysis based on data from the National Gas Reserve Study ³ (NGRS) also indicates the importance of the "old" fields to our national gas supply. This analysis shows that one-half of the 108 largest gas fields in the U.S., at the end of 1970, were discovered before 1950. Although data are not available to update this analysis, information relating to the 50 largest gas fields at the end of 1974 ⁴ indicates that there has been little change in the situation.

There is additional evidence that the frequency of finding large or "significant" fields is declining. Information developed by the American Association of Petroleum Geologists⁵ (AAPG) shows a downward trend in the number of significant gas fields being discovered. The AAPG classifies new field discoveries by size after examining six years of development history. They define as "significant" any gas field containing more than 6 billion cubic feet of ultimately recoverable proved reserves. The significant fields are further subdivided into the following four categories:

Class A-Fields	Over 300 billion cubic feet of gas
Class B-Fields	150 to 300 billion cubic feet of gas
Class C-Fields	60 to 150 billion cubic feet of gas
Class D-Fields	6 to 60 billion cubic feet of gas

The AAPG's data show a decline in both total significant fields and in fields in the "A" category. This latter category is particularly important because it would include giant fields (over 1 Tcf) that might be discovered. The number of significant gas field discoveries declined from 99 in 1957 to 44 in 1969, the last year for which six years of development history is available. There were 9 "A" field discoveries in 1957 which was exceeded only in 1951 and 1952 when 10 Class "A" fields were discovered. Table 2 lists total significant discoveries, "A" field discoveries and ultimate gas reserves discovered during the 1957-1969 period.

The sharp decline in the discovery of significant gas fields starting in the 1950's may have been the initial indication that the easier to find portion of our natural gas resource base had been discovered. However, the approach of the current gas shortage was masked by the fairly satisfactory level of annual reserve additions through 1967, sustained in large part by the continued development of previously discovered fields.

The decline in the number of significant gas field discoveries since 1957 and the close relationship of this decline with ultimate reserves for all fields discovered grouped by year of discovery are shown on Figure 1.

THE DECLINING DISCOVERY RATE

Another revealing statistical relationship is the 30 year gas discovery rate derived by dividing each year's total wildcat exploratory footage into the ultimate volume of new gas supply discovered each year. This relationship is shown in Figure 2. The discovery estimates used are from the AGA's Ultimate Recovery of Natural Gas by Year of Discovery series.⁶ This is a dynamic series where the annual estimates change each year as they are adjusted to account for additions, revisions and new reservoir discoveries. Because the reserves found in the most recent years are still undergoing development, that portion of the curve representing the last five or six years is conservative and will require modification as additional data

become available in the future. In 1947 the average foot of wildcat exploratory hole, which is aimed at the discovery of a new field, resulted in the discovery of more than 800 Mcf of gas but since then the average discovery rate has constantly declined.

In two important respects the decline in the discovery rate has actually been worse than the data suggest. During the years prior to 1960 the search was directed primarily to oil and the gas discoveries were in large measure incidental to that search. Starting during the early 1960's an increasing portion of the search was directed toward finding gas. Yet, even with this purposeful effort to find gas, the gas discovery rate has continued to decline. The other point is that although there have been continuous improvements in exploration technology during the years since 1945, these improvements have not been sufficient to stabilize or halt the decline in discoveries of gas per unit of drilling effort.

THE DECLINE IN NON-ASSOCIATED GAS WELL PRODUCTIVITY

In spite of the encouraging increase in successful gas well drilling in all areas except South Louisiana, there has not been a commensurate increase in new gas reserve additions. (See Figure 3) Since 1971 the number of successful gas well completions drilled annually has increased by almost 98 percent from 3,830 in 1971 to 7,580 in 1975. Preliminary data for 1976 indicate that this trend is continuing.

The lack of gas supply response to the increase in drilling

is illustrated by the decline in the amount of new gas reserves added per foot of drilling effort (productivity). The data on Table 3 illustrates how the amount of new non-associated gas reserves added (exclusive of revisions) per foot of successful gas well drilling has declined over the past 10 years. This decline in productivity is probably due in large measure to the fact that the drilling activity has occurred primarily in the geologic provinces which have already been the most intensively explored. The probability of finding large fields in these areas is smaller than in less well-explored areas because of the finite nature of the natural gas resource base. In effect, the more intensely a geologic province has been drilled, the less gas can be expected to be discovered per future unit of drilling effort. Probably the only way to significantly increase reserve additions would be to shift the emphasis on gas well drilling to those areas where the productivity factor has been historically high and to the frontier areas which may contain large undiscovered fields.

THE ULTIMATE NATURAL GAS RESOURCE BASE

The primary constraint on prospects for future gas supply is the finite nature and present level of development of the natural gas resource base. Many estimates of the domestic natural gas resource base have been made in the past based on varying criteria and methodologies. Until recently these estimates varied widely in magnitude. The most current estimates are in

general far lower and compare more closely than the previous estimates. The ultimate resource base is composed of all the natural gas that has been found to date and includes cumulative production, proved reserves and probable (or inferred) reserves plus undiscovered resources.

These estimates indicate quantitatively where the Nation presently stands with respect to the exploitation of its ultimate natural gas resource base and provide a rough idea of the level of gas discoveries that we can expect in the future. Table 4, which utilizes the most recent USGS estimates ⁷ because they indicate a range which includes most of the current estimates from other sources, relates the gas reserves which have been discovered since the start of the oil and gas industry and the current USGS estimates of gas resources yet to be discovered.

It may be observed from the table that if it is assumed that the low range of the USGS undiscovered resource estimate is correct, then three-quarters of our ultimate resource base has already been discovered. If the higher end of the range is used, then about 60 percent of our ultimate natural gas resource has been discovered. In any event, with the possible exception of Alaska, and the Atlantic and Pacific Outer Continental Shelf areas where little or no exploration has occurred, the majority of our large fields have probably already been found. Additionally, there is a growing concern among government and industry geologists that the Gulf of Mexico area is apparently running

out of first class oil and gas prospects. This area had been expected to play an increasingly important role in meeting our future gas supply requirements.

Responses to the more recent lease sales are indicative of increasing pessimism on the part of the industry. Illustrative of these depressed industry expectations is the fact that prior to 1974 over 62 percent of the acreage offered in the Gulf of Mexico OCS wildcat lease sales was leased. In 1974, 1975 and 1976, this percentage dropped to 44, 23 and 21 percent respectively. Furthermore, the average bonuses paid for wildcat acreage in the Gulf was \$3079 per acre in 1974, only \$490 per acre in 1975, and \$1066 in 1976.

Thus, despite a high level of successful gas well drilling today, the results have been disappointing in terms of total new gas supply. New discoveries in the traditional producing areas have been small and the role which will be played by the frontier areas remains to be established.

FUTURE PRODUCTION CAPABILITY

Gas production increased at an annual rate of about 7 percent for more than 25 years until 1970 when the growth curve flattened out. Between 1970 and 1973, production increased only slightly followed by sharp declines in 1974 and 1975. Preliminary data for 1976 indicate that natural gas production continued on this downward trend but at a substantially reduced rate of decline when compared to the precipitous 4.6 and 6.9 percent decreases experienced in 1974 and 1975 respectively. FPC staff analyses and studies indicate that this decline in production after so

many years of growth is primarily the result of declining productive capability. However, energy conservation, warmer-than-normal weather prior to the winter of 1976 - 1977, and the recent economic recession may have also had some effect on production.

Our analysis of historical natural gas reserve additions and prospects for future reserve additions indicates that annual production will continue to decline, even assuming successful exploration and development of the frontier areas. Figure 4 depicts historical gas production for the years 1960 through 1974 and displays projections of future conventional natural gas production through 1985, including new production from the frontier areas.

The projection of productive capability for the lower 48 states' traditional gas producing areas (Curve (1) on Figure 4), is based on average reserve additions of 9.3 Tcf per year. This level of reserve additions is equal to the average experienced in the lower 48 states during the 1968-1974 period which we believe is a reasonable but optimistic level of reserve additions to expect from our traditional gas supply areas over the next 9 years. Curve (2) on Figure 4 shows projected production levels for gas from traditional lower 48 state producing areas plus onshore Alaskan gas (primarily gas from Prudhoe Bay and the Cook Inlet area). Curves (3) and (4) include possible new production from the Atlantic, Pacific and Alaskan Outer Continental Shelf (OCS) areas. Curves (1) and (2) are regarded as reasonable but optimistic.

We project that production from present gas supply areas will decrease by about one-third to about 14 Tcf by 1985 and, even with successful development of the offshore areas of the Atlantic, Pacific and Alaska, overall production will have dropped about 20 percent to approximately 17 Tcf by 1985.

It is apparent that projections of production from the frontier areas, with the exception of Alaska's North Slope where the gas reserves have already been discovered and only the timing and volume of production is still in doubt, are highly speculative because it is not known with certainty that these frontier areas contain hydrocarbons in commercial quantities, or whether these areas will be oil prone, gas prone, or both.

The speculative nature of U.S. offshore exploration is clearly indicated by the historical record. For example, exploratory drilling on leases purchased in two previous major offshore lease sales, the Washington-Oregon lease sale of October 1964 and the Mississippi, Alabama and Florida (MAFLA) sale of December 1973, has resulted in no commercial discoveries of oil or gas. Twelve unsuccessful exploratory test wells were drilled on acreage leased in the Washington-Oregon sale and all of this acreage was eventually released to the government. Similar results were obtained on leases purchased in the MAFLA sale where drilling was suspended in 1975 after 15 dry holes were drilled. The lack of discoveries on the MAFLA acreage was

especially disappointing because the area was believed to have a significant undiscovered hydrocarbon potential as evidenced by the \$1.5 billion paid by industry in lease bonuses.

There are in addition other factors that affect the reliability of projections of production from the frontier areas such as: (a) the rate at which the industry will be capable of processing the acreage that may be leased as a result of proposed lease sales by the Interior Department and (b) the likelihood that the lag time between discovery and initial production may vary several years from one frontier area to another.

The production projections for these areas were based on the Interior Department's leasing schedule as enunciated in June of 1975. ⁸ That schedule was revised by Interior in mid-January of 1977 but is not anticipated to significantly affect our projections of production. Scheduled exploration of our OCS frontier areas has been set back somewhat by the recent invalidation of the August 1976 Atlantic OCS lease sale and by the cancellation of the proposed February 1977 Alaska Cook Inlet sale. Undoubtedly further changes in the presently anticipated lease sale schedule will occur. In any event, the timely offering and successful development of these OCS areas as well as the early provision of the required natural gas transportation systems is necessary if our projected levels of production are to be attained.

SUPPLEMENTAL GAS SUPPLIES

There are of course several sources of supplemental gas which could help offset the anticipated decline in conventional natural gas supply. The most significant of these in the 1975-85 time-frame appear to be pipeline imports from Canada, liquefied natural gas (LNG) imports, coal gasification, substitute natural gas (SNG) produced from liquid hydrocarbons and the stimulation of low-permeability natural gas reservoirs.

The most recent in-depth FPC staff analysis of the potential availability of gas from these sources was done during 1973 as a part of the National Gas Survey and a more up to date staff analysis is currently being developed as a part of the continuing National Gas Survey work. Since 1973 the outlook for the availability of gas from these sources by 1985 has deteriorated markedly, however, and those supplemental gas sources which appeared most promising only three years ago are experiencing serious difficulties and delays today. Movement toward the development of these sources has been impeded by many factors including unexpected escalations in project costs, environmental considerations, investor uncertainty over inflation, high interest rates, domestic and foreign government energy policies and, in the case of synthetic gas production technologies, lack of FPC jurisdiction. The regulatory processes required under the law by numerous Federal, State and local agencies have also proved to be very complex and time consuming procedures.

The impact of these factors upon supplemental gas supply availability within the 1976-1985 time-frame will be such that only a modest portion of our future natural gas deficit will be met from supplemental sources.

CONCLUSIONS

The decline in available natural gas supplies, which we are experiencing at present, is an event which prestigious authorities warned us about twenty-five years ago. Unfortunately, the warning was ignored by the government, by the industry, and by the public. Discussions of our current gas supply problems have now largely degenerated into attempts to fix blame, on the one hand, and to demands for massive wellhead price increases, on the other hand. However, if our analyses concerning characteristics of the resource base and future productive capability are correct, then we cannot expect price increases to provide the solution to declining gas production. While increased price incentives might ameliorate the situation somewhat, our policies should be based on the expectation of decreasing gas availability.

There are a number of factors that may be accentuating the gas shortage, such as uncertainty concerning wellhead price, demand for gas to solve air pollution problems, deficiencies in the offshore leasing program, and the profligate use of gas in certain areas for low priority purposes. Yet the basic underlying cause of the gas shortage is the simple fact that the

Nation is running short of economically recoverable gas resources that can be readily converted to producible reserves.

Supplementary gas sources such as gas from coal, imported liquefied natural gas, and pipeline imports from the far north are encountering serious delays and difficulties and will meet only a portion of the future natural gas deficit. Gas from these sources will be expensive and slow to reach markets. Even so, these supplementary gas sources must be pursued vigorously. The Nation's frontier areas--the Atlantic and Pacific Outer Continental Shelf and Alaska--are believed to have the potential for significant future discoveries and their exploration should be given a high priority. The frontier areas and supplemental gas sources, however, will provide only a limited supply of gas and if we have learned anything at all from our experiences of the past, other important elements of our national energy policy must also include programs for mandatory natural gas conservation, substitution of alternate fuels for low priority uses of gas and the allocation of scarce gas supplies by Federal, State and local jurisdictions to high priority end uses.

REFERENCES

1. "Natural Gas Investigation (Docket No. G-580)," Report of Commissioners Leland Olds and Claude L. Draper, Federal Power Commission, Washington, D.C. (1948) 15.
2. "Resources for Freedom: The Outlook for Energy Sources," The President's Materials Policy Commission, Washington, D.C. (June, 1952) Vol. III, 16, 23.
3. "National Gas Reserves Study," Federal Power Commission National Gas Survey, Staff Report, Washington, D. C. (Revised September 1973).
4. "Estimates of Gas Reserves and Productive Capacities of 50 Largest Gas Fields in U.S. (As of December 31, 1974)," American Gas Association, Arlington, Va. (April, 1975).
5. Johnson, Robert R., "North American Drilling Activity in 1975," AAPG Bulletin. (August, 1976) Vol. LX, 1178.
6. "Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada as of December 31, 1975," American Gas Association, American Petroleum Institute, and Canadian Petroleum Association (May, 1976) Vol. XXX, 172.
7. Miller, Betty M., Thomsen, Harry L., Dolton, Gordon L., et al, "Geological Estimates of Undiscovered Recoverable Oil and Gas Resources in the United States," U.S. Geological Survey, Reston, Va. (1975).
8. "Effects of Offshore Oil and Natural Gas Development on the Coastal Zone," sponsored by the Ad Hoc Select Committee on Outer Continental Shelf, House of Representatives. The Library of Congress Congressional Research Service, Washington, D.C. (March, 1976) 99.

Table 1
UNITED STATES NATURAL GAS SUPPLY EXCLUDING ALASKA*
1946-1975

(All Volumes in Trillions of Cubic Feet @ 14.73 Psia and 60°F.)

Year (1)	Production (2)	Reserve Additions (3)	Proved Reserves (4)	R/P Ratio		F/P Ratio	
				(4)	(2)**	(3)	(2)**
				(5)		(6)	
1946	4.9	17.6	159.7	32.5		3.6	
1947	5.6	10.9	165.0	29.5		1.9	
1948	6.0	13.8	172.9	28.9		2.3	
1949	6.2	12.6	179.4	28.9		2.0	
1950	6.9	12.0	184.6	26.9		1.7	
1951	7.9	16.0	192.8	24.3		2.0	
1952	8.6	14.3	198.6	23.1		1.7	
1953	9.2	20.3	210.3	22.9		2.2	
1954	9.4	9.6	210.6	22.5		1.0	
1955	10.1	21.9	222.5	22.1		2.2	
1956	10.9	24.7	236.5	21.8		2.3	
1957	11.4	20.0	245.2	21.4		1.7	
1958	11.4	18.9	252.8	22.1		1.7	
1959	12.4	20.6	261.2	21.1		1.1	
1960	13.0	13.8	262.2	20.1		1.2	
1961	13.4	16.4	265.4	19.8		1.4	
1962	13.6	18.8	270.6	19.9		1.2	
1963	14.5	18.1	274.5	18.9		1.3	
1964	15.3	20.1	279.4	18.2		1.3	
1965	16.2	21.2	284.5	17.5		1.1	
1966	17.5	19.2	286.4	16.4		1.1	
1967	18.4	21.1	289.3	15.7		0.6	
1968	19.3	12.0	282.1	14.6		0.4	
1969	20.6	8.3	269.9	13.1		0.5	
1970	21.8	11.1	259.6	11.9		0.4	
1971	21.9	9.4	247.4	11.3		0.4	
1972	22.4	9.4	234.6	10.5		0.3	
1973	22.5	6.5	218.3	9.7		0.4	
1974	21.2	8.3	205.3	9.7		0.5	
1975	19.6	10.1	196.1	10.0			

* Data represents total U.S. natural gas supply prior to 1960. Alaska's natural gas supply was not reported until 1960. Includes gas in underground storage.

** Computed prior to rounding.

Source: A.G.A.

Table 2

"SIGNIFICANT" GAS FIELD DISCOVERIES BY YEAR
(1957-1969)

<u>Year</u>	<u>Number of Significant Gas Field Discoveries</u>		<u>Ultimate Gas Reserves By Year of Discovery (Tcf)</u>
	<u>Total Fields</u>	<u>A-Fields</u>	
1957	99	9	15.7
1958	73	3	20.2
1959	62	4	10.8
1960	80	6	12.0
1961	46	4	10.5
1962	79	3	12.2
1963	50	4	12.5
1964	53	4	9.3
1965	52	1	7.9
1966	47	1	7.5
1967	41	4	5.2
1968	40	1	6.6*
1969	44	3	6.4

* Excludes the 26 Tcf discovered in the Prudhoe Bay field.
Source: A.A.P.G. and A.G.A.

Table 3

NON-ASSOCIATED RESERVES
DEVELOPED PER SUCCESSFUL FOOT DRILLED
LOWER 48 STATES

<u>Year</u>	<u>Reserve Additions (Bcf)*</u>	<u>Successful Gas Well Footage (Thousands of Feet)</u>	<u>Productivity (Mcf/Foot)</u>	<u>Percent Change In Productivity</u>
1966	13,079	24,390	536	--
1967	13,571	20,789	653	+21.8
1968	8,298	20,119	412	-36.9
1969	8,315	24,064	346	-16.0
1970	9,641	22,852	422	+22.0
1971	10,037	22,609	444	+ 5.2
1972	9,508	26,744	356	-19.8
1973	9,064	35,587	255	-28.4
1974	8,514	38,975	218	-14.5
1975	9,197	41,898	220	+ 0.9

* Includes extensions, new field discoveries and new reservoir discoveries but excludes revisions.

Source: A.G.A. and A.P.I.

Table 4

ULTIMATE NATURAL GAS RESOURCE BASE
(Volumes in Trillion Cubic Feet)

	<u>Discovered Reserves*</u>	<u>Undiscovered Resources</u>	<u>Ultimate Resource Base</u>	<u>Discovered Reserves As a % Of Ultimate Resource Base</u>
Lower 48 States	867	286 - 529	1153-1396	75 - 62
Alaska	48	29 - 132	77-180	62 - 27
Total U.S.	915	322 - 655	1237-1570	74 - 58

* Includes cumulative production, proved reserves and
inferred reserves.
Source: U.S.G.S. Circular 725

Figure 1

**NUMBER OF SIGNIFICANT GAS DISCOVERIES
AND ULTIMATE RESERVES
BY YEAR OF DISCOVERY
(3-YEAR MOVING AVERAGES)**

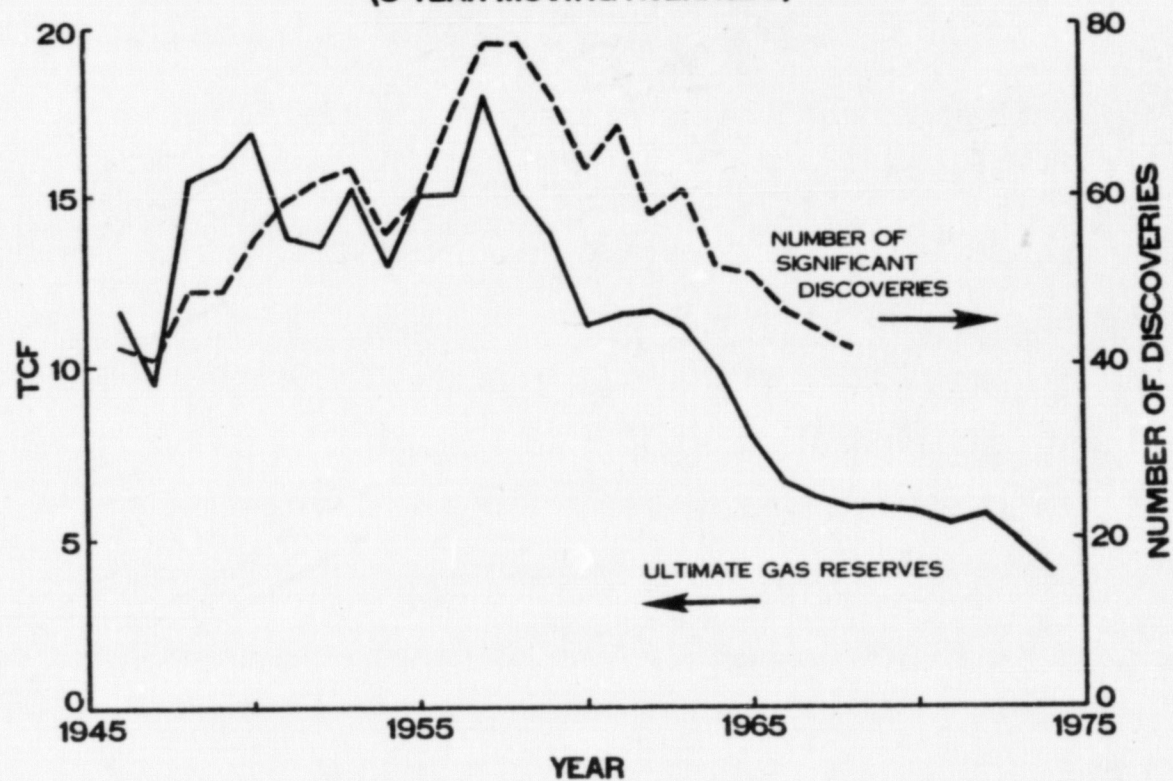


Figure 2

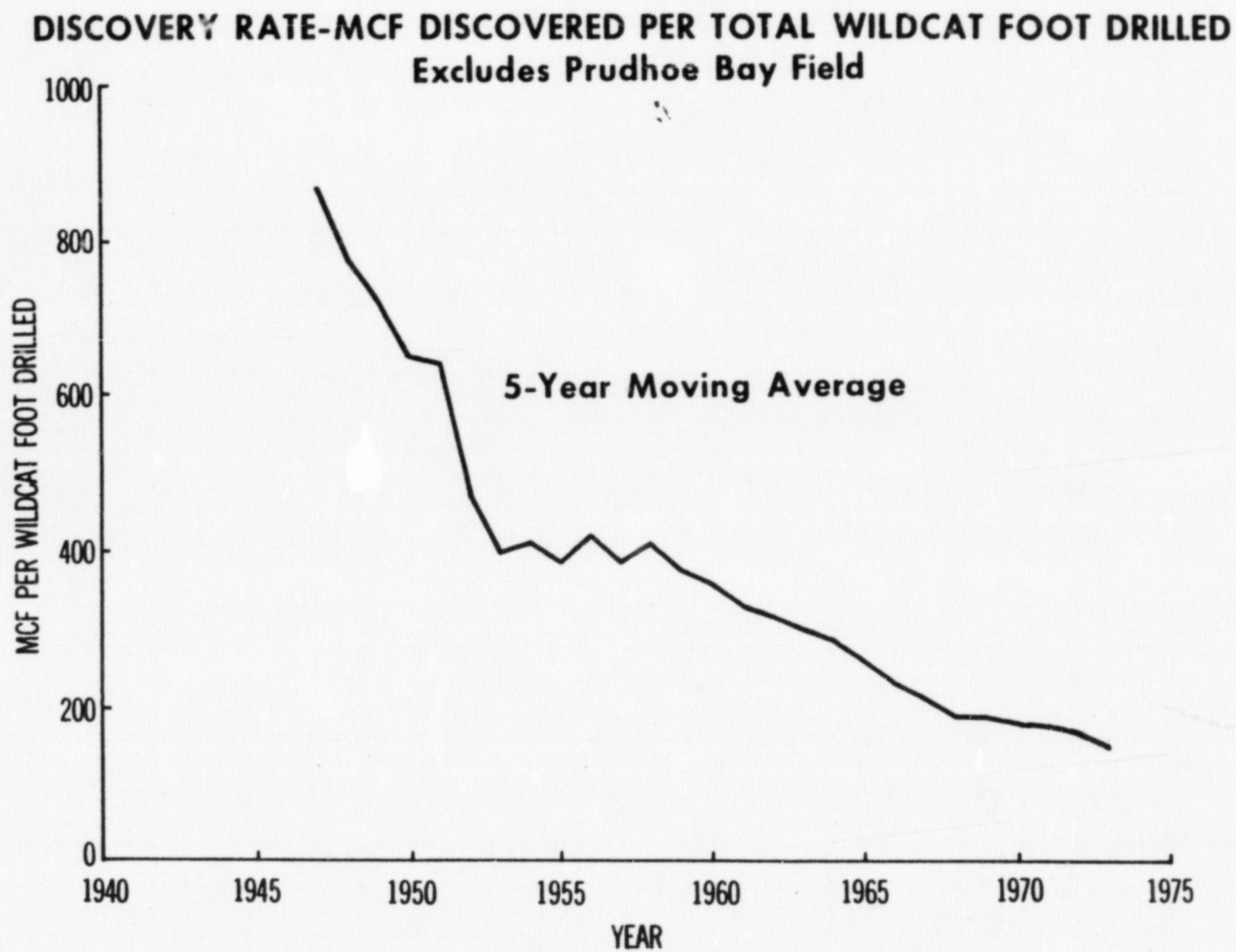


Figure 3

DOMESTIC GAS SUPPLY

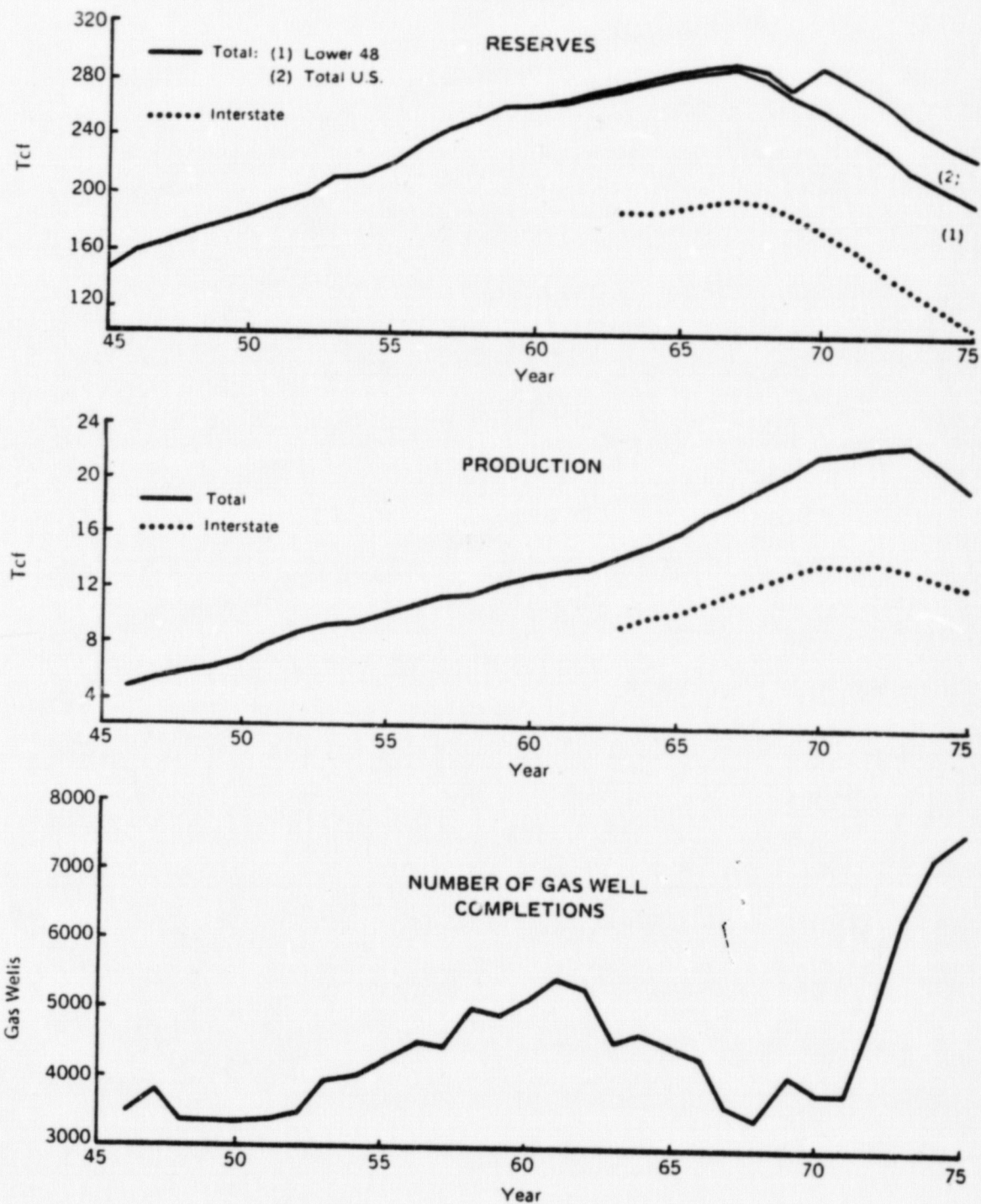
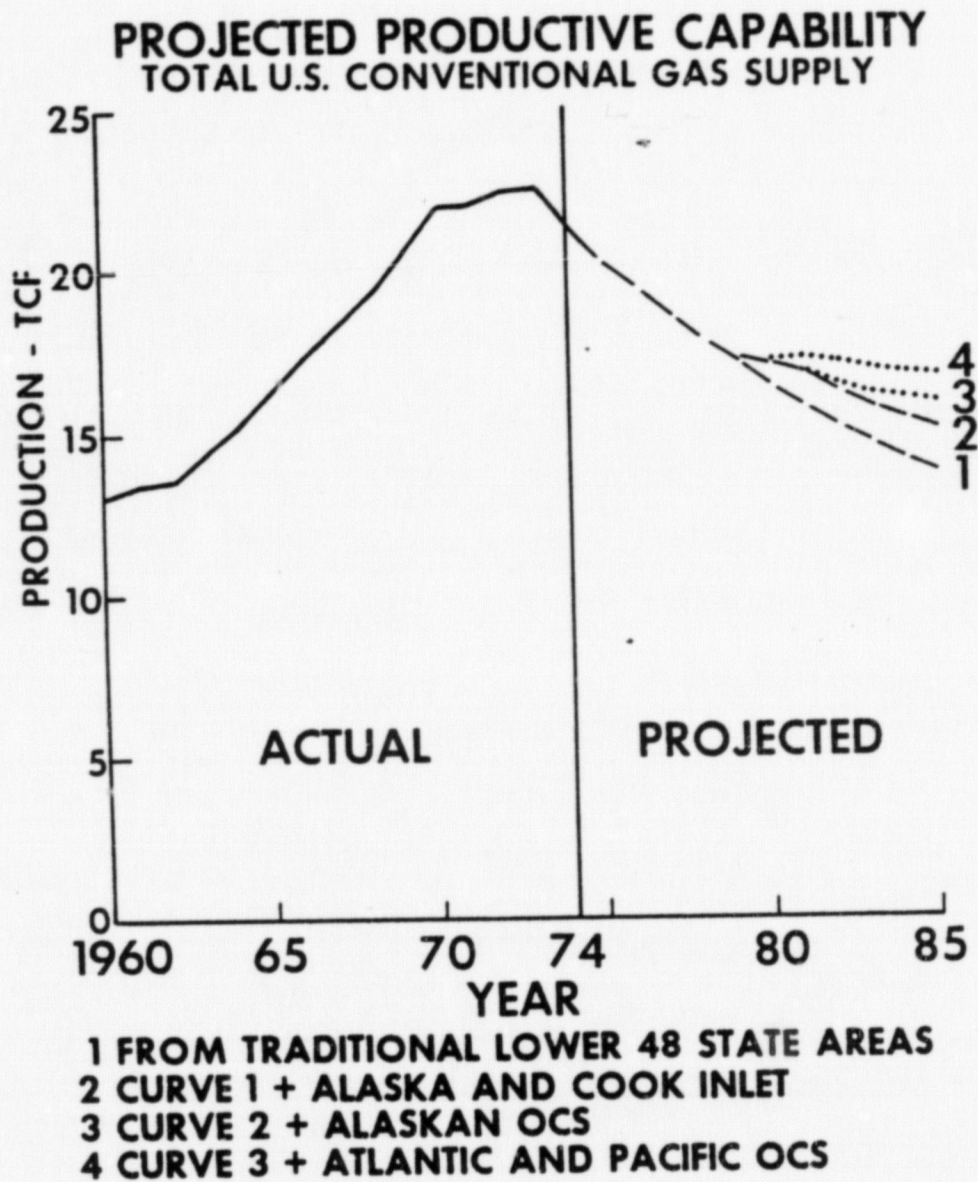


Figure 4



APPENDIX A

The attached series of tables and figures traces the development of domestic natural gas supply on both a national and regional level. The tables include two sets of reserve and production data. The first set of data on each table is based on American Gas Association statistics and relates to total gas supply. The second set of data is based on FPC Form 15 information and includes only interstate gas supply statistics. The tables are accompanied by figures which graphically display the reserve and production data plus successful gas well completion information.

By the end of 1975 all of the gas supply areas except Alaska, Appalachia, All Other and the Louisiana Offshore Federal Domain exhibited declining total reserves trends, although the latter area's total reserves peaked in 1972. Total reserves reached peak levels in the other areas ranging from 1958 for the Rocky Mountains to 1968 for South Louisiana. Interstate reserves declined in all areas in 1975 and, in general, parallel the total reserves trends for the various areas with the exception of Appalachia where interstate reserves have been declining since 1964.

Total production continued to increase into the early seventies in most of the areas. By the end of 1975, however, only the Louisiana Offshore Federal Domain area was still exhibiting an increasing production trend. Interstate production trends are similar to the total production trends in the important supply areas except for the Permian Basin area where interstate production

reached a peak in 1971.

.. Successfully completed gas wells have trended sharply upward
* since 1971 with this trend generally reflected in all major
* producing areas with the exception of the important South Louisiana
* area. Preliminary data for 1976 indicate that this trend is
continuing.

Table 1 1/2/
TOTAL UNITED STATES
(VOLUMES IN TRILLIONS OF CUBIC FEET)

SOURCE: AGA

YR	PROD	RESERVES	GROSS R.A.	REVISIONS	NET R.A.	R/P RATIO
45	N.A.	146.986723	N.A.	N.A.	N.A.	N.A.
46	4.915774	159.703813	N.A.	N.A.	17.632864	32.5
47	5.599235	165.025765	N.A.	N.A.	10.921187	29.5
48	5.975001	172.925056	N.A.	N.A.	13.823090	28.9
49	6.211124	179.401693	N.A.	N.A.	12.605615	28.9
50	6.855244	184.584745	N.A.	N.A.	11.985361	26.9
51	7.923673	192.758910	N.A.	N.A.	15.965808	24.3
52	8.592716	198.631566	N.A.	N.A.	14.267606	23.1
53	9.188365	210.298763	N.A.	N.A.	20.341933	22.9
54	9.375314	210.560931	N.A.	N.A.	9.547074	22.5
55	10.063167	222.482544	N.A.	N.A.	21.897616	22.1
56	10.848686	236.483215	N.A.	N.A.	24.716115	21.8
57	11.439891	245.230138	N.A.	N.A.	20.008056	21.4
58	11.422651	252.761790	N.A.	N.A.	18.896717	22.1
59	12.373064	261.170431	N.A.	N.A.	20.621254	21.1
60	13.019357	262.326330	N.A.	N.A.	13.893980	20.1
61	13.378650	266.273641	N.A.	N.A.	17.166421	19.9
62	13.637973	272.278782	N.A.	N.A.	19.483956	20.0
63	14.546025	276.151233	N.A.	N.A.	18.164668	19.0
64	15.347028	281.251454	N.A.	N.A.	20.252138	18.3
65	16.252293	286.468923	N.A.	N.A.	21.319279	17.6
66	17.491073	289.332805	15.282470	4.937962	20.220432	16.5
67	18.380838	292.907703	15.233755	6.570578	21.804333	15.9
68	19.373428	287.349852	10.680862	3.016146	13.697008	14.8
69	20.723190	275.108835	9.613265	-1.238261	8.375004	13.3
70	21.960804	290.746408	37.296080	-0.099721	37.196359	13.2
71	22.076512	278.805618	11.052821	-1.227400	9.825421	12.6
72	22.511898	266.084846	10.712354	-1.077791	9.634563	11.8
73	22.605406	249.950207	10.299805	-3.474756	6.825049	11.1
74	21.318470	237.132497	10.012469	-1.333285	8.679184	11.1
75	19.718570	228.200176	10.100239	0.383449	10.483688	11.6

SOURCE: FORM 15

YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	9.351	188.540	N.A.	20.2
64	10.015	189.165	10.640	18.9
65	10.371	192.077	13.282	18.5
66	11.127	195.130	14.190	17.5
67	11.820	198.061	14.751	16.8
68	12.552	194.962	9.453	15.5
69	13.423	187.609	6.081	14.0
70	14.092	173.556	0.038	12.3
71	14.205	161.341	1.991	11.4
72	14.207	146.906	-0.229	10.3
73	13.680	134.317	1.092	9.8
74	12.965	120.543	-0.810	9.3
75	11.992	106.816	-1.734	8.9

Table 1A
LOWER 48 STATES
(VOLUMES IN TRILLIONS OF CUBIC FEET)

SOURCE: AGA

YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
45	N.A.	146.986723	N.A.	N.A.	N.A.	N.A.
46	4.915774	159.703813	N.A.	N.A.	17.632864	32.5
47	5.599235	165.025765	N.A.	N.A.	10.921187	29.5
48	5.975001	172.925056	N.A.	N.A.	13.823090	28.9
49	6.211124	179.401693	N.A.	N.A.	12.605615	28.9
50	6.855244	184.584745	N.A.	N.A.	11.985361	26.9
51	7.923673	192.758910	N.A.	N.A.	15.965808	24.3
52	8.592716	198.631566	N.A.	N.A.	14.267606	23.1
53	9.188365	210.298763	N.A.	N.A.	20.341933	22.9
54	9.375314	210.560931	N.A.	N.A.	9.547074	22.5
55	10.063167	222.482544	N.A.	N.A.	21.897616	22.1
56	10.848386	236.483215	N.A.	N.A.	24.716115	21.8
57	11.439891	245.230138	N.A.	N.A.	20.008056	21.4
58	11.422651	252.761790	N.A.	N.A.	18.896717	22.1
59	12.373064	261.170431	N.A.	N.A.	20.621254	21.13/
60	13.019054	262.219252	N.A.	N.A.	13.844259	20.1
61	13.377008	265.351846	N.A.	N.A.	16.350062	19.8
62	13.634408	270.644461	N.A.	N.A.	18.767866	19.9
63	14.541496	274.460509	N.A.	N.A.	18.103736	18.9
64	15.340611	279.420089	N.A.	N.A.	20.105080	18.2
65	16.244691	284.483598	N.A.	N.A.	21.157717	17.5
66	17.478154	286.385943	14.783970	4.462006	19.245976	16.4
67	18.358272	289.272449	14.837105	6.256270	21.093375	15.8
68	19.331747	282.097528	9.817312	2.220945	12.038257	14.6
69	20.635854	269.906692	9.613265	-1.275416	8.337849	13.1
70	21.815604	259.615657	11.278580	-0.156029	11.122551	11.9
71	21.922927	247.440277	11.052821	-1.615575	9.437246	11.3
72	22.365162	234.629403	10.712354	-1.314629	9.397725	10.5
73	22.474591	218.307581	10.053205	-3.546154	6.507051	9.7
74	21.174540	205.265885	9.658469	-1.347201	8.311268	9.7
75	19.563338	196.149427	9.977239	0.167080	10.144319	10.0

SOURCE: FORM 15

YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	9.351	188.540	N.A.	20.2
64	10.015	189.165	10.640	18.9
65	10.371	192.077	13.282	18.5
66	11.137	195.130	14.190	17.5
67	11.820	198.061	14.751	16.8
68	12.552	194.962	9.453	15.5
69	13.433	187.609	6.081	14.0
70	14.092	173.556	0.038	12.3
71	14.205	161.341	1.991	11.4
72	14.207	146.906	-0.229	10.3
73	13.680	134.317	1.092	9.8
74	12.965	120.543	-0.810	9.3
75	11.992	106.816	-1.734	8.9

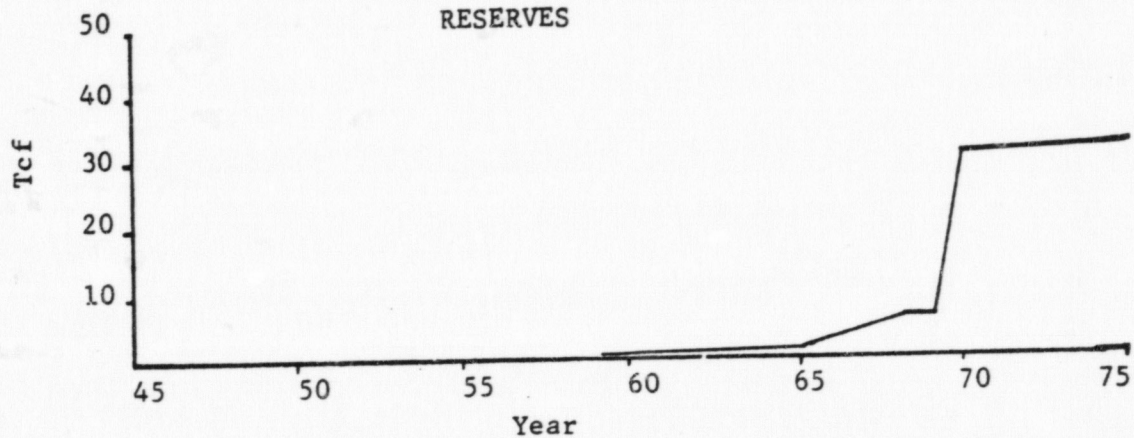
Table 2

ALASKA
(VOLUMES IN TRILLIONS OF CUBIC FEET)

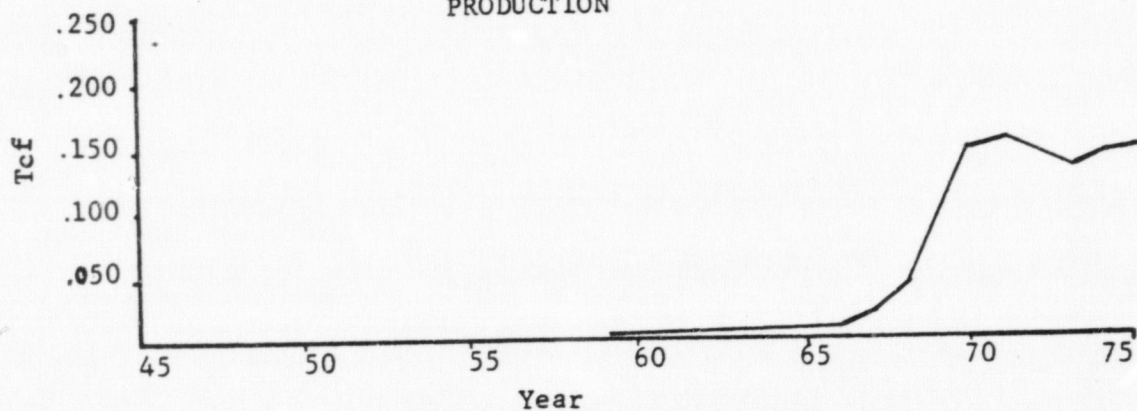
SOURCE: AGA

YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
59	N.A.	0.057660	N.A.	N.A.	N.A.	N.A.
60	0.000303	0.107078	N.A.	N.A.	0.049721	353.4
61	0.001642	0.921795	N.A.	N.A.	0.816359	561.4
62	0.003565	1.634321	N.A.	N.A.	0.716090	458.4
63	0.004529	1.690724	N.A.	N.A.	0.060932	373.3
64	0.006417	1.831365	N.A.	N.A.	0.147058	285.4
65	0.007602	1.985325	N.A.	N.A.	0.161562	261.2
66	0.012919	2.946862	0.498500	0.475956	0.974456	228.1
67	0.022566	3.635254	0.396650	0.314308	0.710958	161.1
68	0.041681	5.252324	0.863550	0.795201	1.658751	126.0
69	0.087336	5.202143	0.0	0.037155	0.037155	59.6
70	0.145200	31.130751	26.017500	0.056308	26.073808	214.4
71	0.153585	31.365341	0.0	0.388175	0.388175	204.2
72	0.146736	31.455443	0.0	0.236838	0.236838	214.4
73	0.130815	31.642626	0.246600	0.071398	0.317998	241.9
74	0.143930	31.866612	0.354000	0.013916	0.367916	221.4
75	0.155232	32.050749	0.123000	0.216369	0.339369	206.5

ALASKA RESERVES



PRODUCTION



NUMBER OF GAS WELL COMPLETIONS

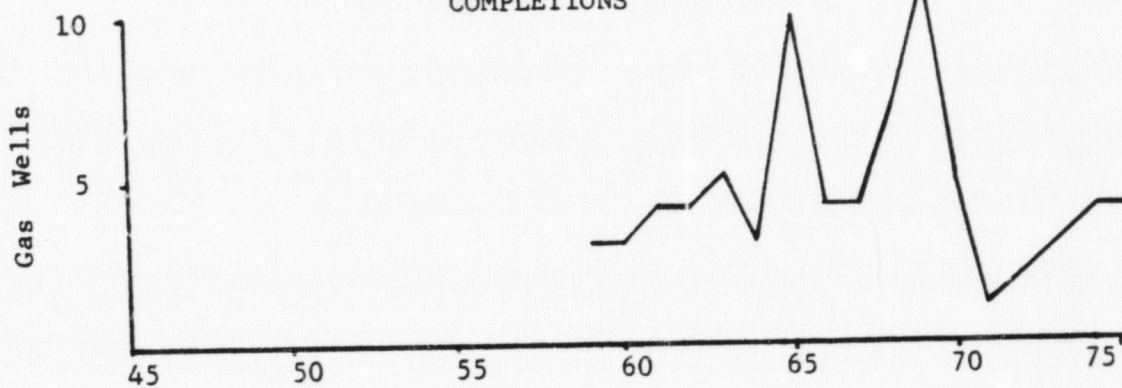


Table 3
SOUTH LOUISIANA
(VOLUMES IN TRILLIONS OF CUBIC FEET)

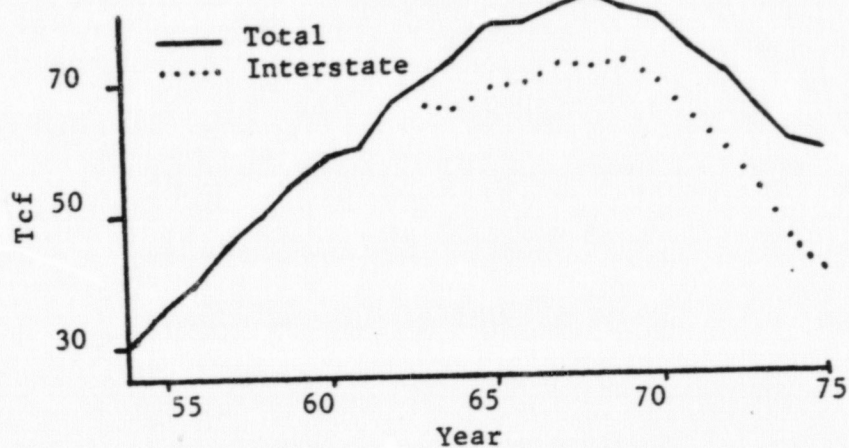
SOURCE: AGA

YR	PRND	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
54	1.018054	30.833713	N.A.	N.A.	3.213932	30.3
55	1.194299	36.377591	N.A.	N.A.	6.738177	30.5
56	1.393433	39.332670	N.A.	N.A.	4.348512	28.2
57	1.587088	45.647335	N.A.	N.A.	7.901753	28.8
58	1.821394	49.048130	N.A.	N.A.	5.222189	26.9
59	2.253681	53.986158	N.A.	N.A.	7.191709	24.0
60	2.488398	57.726093	N.A.	N.A.	6.228333	23.2
61	2.770868	60.369816	N.A.	N.A.	5.414591	21.8
62	2.978552	66.562546	N.A.	N.A.	9.171282	22.3
63	3.351569	70.436530	N.A.	N.A.	7.225553	21.0
64	3.512994	73.880249	N.A.	N.A.	6.956713	21.0
65	4.008330	77.669804	N.A.	N.A.	7.797885	19.4
66	4.566476	78.613308	3.329205	2.180775	5.509980	17.2
67	5.371246	81.423519	3.959993	4.221464	8.181457	15.2
68	6.013455	83.392889	4.272095	3.710730	7.982825	13.9
69	6.789170	80.769437	3.118723	1.046995	4.165718	11.9
70	7.326045	79.093209	4.500204	1.149613	5.649817	10.8
71	7.680422	74.968645	5.228077	-1.680878	3.547199	9.8
72	7.987650	71.651006	3.898162	0.765666	4.663828	9.0
73	8.045165	66.175480	3.165716	-0.596319	2.569397	8.2
74	7.353051	61.215891	3.002079	-0.608550	2.393529	8.3
75	6.852731	58.679750	3.433688	0.879421	4.313109	8.6

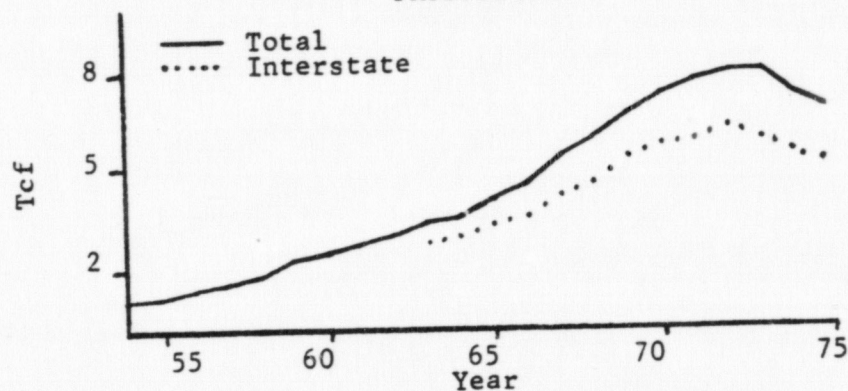
SOURCE: FORM 15

YR	PRND	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	2.724	66.548	N.A.	24.4
64	2.949	65.963	2.364	22.4
65	3.198	68.916	6.150	21.6
66	3.623	69.820	4.527	19.3
67	4.194	72.729	7.104	17.3
68	4.649	72.162	4.082	15.5
69	5.288	73.289	6.415	13.9
70	5.834	69.972	2.517	12.0
71	5.955	64.103	0.086	10.8
72	6.229	59.143	1.269	9.5
73	5.940	53.627	0.424	9.0
74	5.538	46.077	-2.012	8.3
75	5.262	38.924	-1.890	7.4

SOUTH LOUISIANA RESERVES



PRODUCTION



NUMBER OF GAS WELL COMPLETIONS

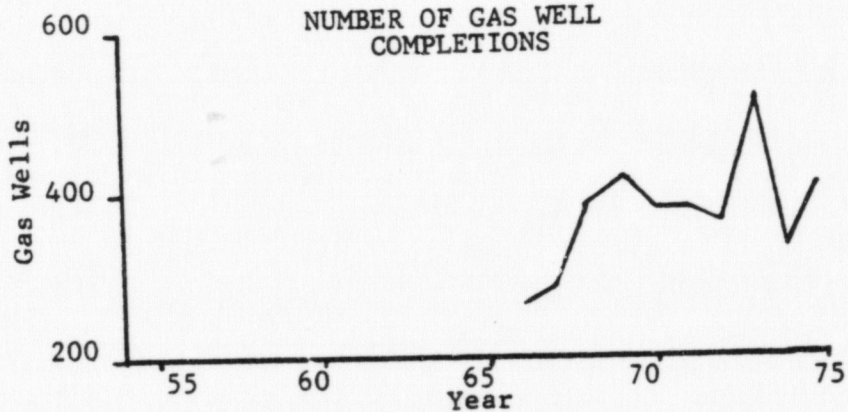


Table 4

ONSHORE SOUTH LOUISIANA + ZONE 1
(VOLUMES IN TRILLIONS OF CUBIC FEET)

SOURCE: AGA

YR	PROD	RESERVES	GROSS R.A.	REVISIONS	NET R.A.	R/P RATIO
54	0.956908	28.657833	N.A.	N.A.	2.993344	29.9
55	1.100545	32.976654	N.A.	N.A.	5.419366	30.0
56	1.297234	35.415096	N.A.	N.A.	3.735676	27.3
57	1.494972	40.536995	N.A.	N.A.	6.616871	27.1
58	1.675868	43.800257	N.A.	N.A.	4.939130	26.1
59	2.013489	46.904407	N.A.	N.A.	5.117639	23.3
60	2.216770	49.679255	N.A.	N.A.	4.991618	22.4
61	2.421084	51.327782	N.A.	N.A.	4.069611	21.2
62	2.508254	56.486024	N.A.	N.A.	7.666496	22.5
63	2.737428	59.070929	N.A.	N.A.	5.322333	21.6
64	2.838845	59.754697	N.A.	N.A.	3.522613	21.0
65	3.278155	60.748160	N.A.	N.A.	4.271618	18.5
66	3.650325	59.239729	1.599722	0.542171	2.141894	16.2
67	4.178399	59.124316	1.890778	2.172208	4.062986	14.1
68	4.540937	59.200280	2.144772	2.472129	4.616901	13.0
69	5.000939	56.666983	1.313659	1.153983	2.467642	11.3
70	5.103234	52.658138	1.785473	-0.691084	1.094389	10.3
71	5.197922	47.128723	1.209795	-1.549947	-0.340152	9.1
72	5.174552	42.919602	0.907045	0.052203	0.959248	8.3
73	4.849670	38.084856	0.923339	-0.908657	0.014682	7.9
74	4.091299	34.224699	1.052240	-0.821031	0.231209	8.4
75	3.569129	30.596005	0.808959	-1.245170	-0.436211	8.6

SOURCE: FORM 15

YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	2.248	53.736	N.A.	23.9
64	2.411	52.579	1.254	21.8
65	2.612	53.265	3.298	20.4
66	2.920	52.626	2.281	18.0
67	3.357	53.062	3.793	15.8
68	3.639	49.796	0.373	13.7
69	3.935	47.428	1.567	12.1
70	4.025	42.837	-0.566	10.6
71	3.911	38.474	-0.452	9.8
72	3.250	32.889	-1.626	8.3
73	3.395	28.442	-1.052	8.4
74	2.796	23.617	-2.029	8.4
75	2.395	20.113	-1.108	8.4

ONSHORE SOUTH LOUISIANA + ZONE 1

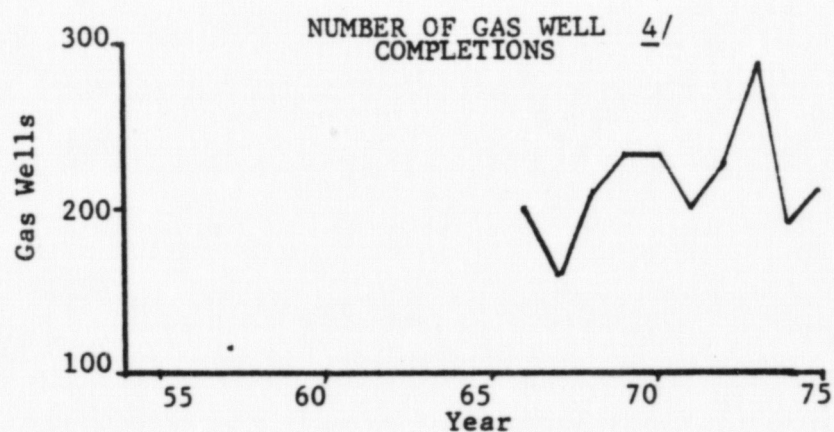
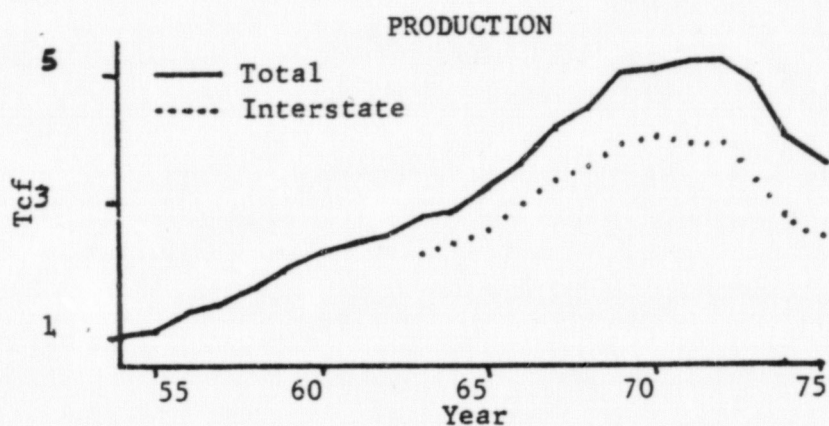
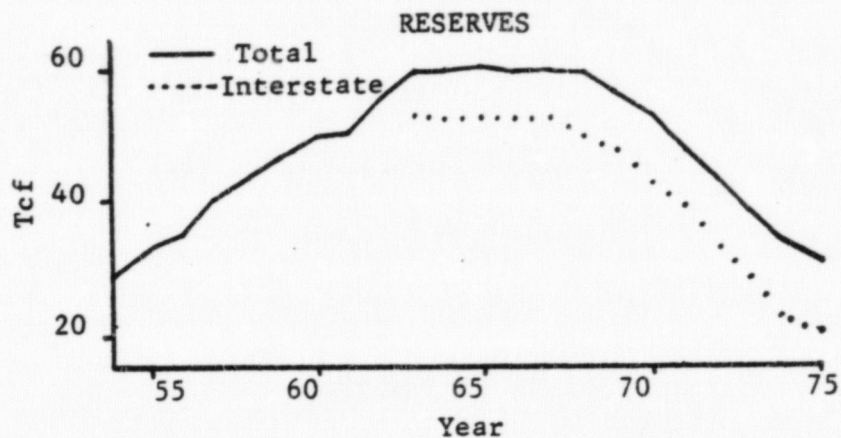


Table 5

SOUTH LOUISIANA ZONES 2,3,4
(VOLUMES IN TRILLIONS OF CUBIC FEET)

SOURCE: AGA

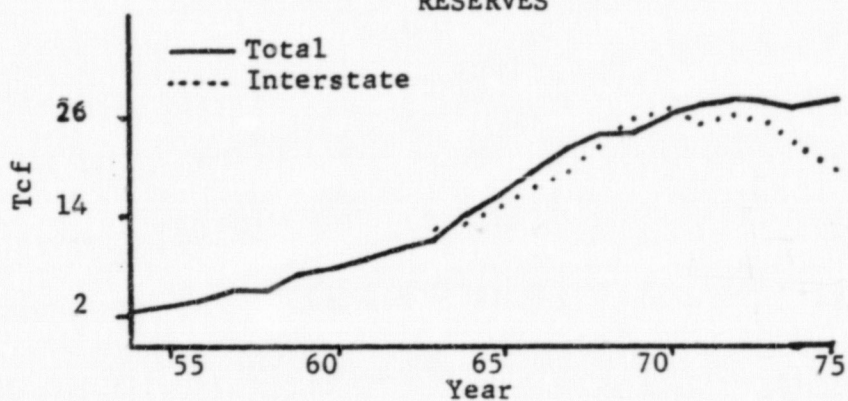
YR	PROD	RESERVES	GROSS R.A.	REVISIONS	NET R.A.	R/P RATIO
54	0.061146	2.175880	N.A.	N.A.	0.220588	35.6
55	0.093754	3.400937	N.A.	N.A.	1.318811	36.3
56	0.096199	3.917574	N.A.	N.A.	0.612836	40.7
57	0.092116	5.110340	N.A.	N.A.	1.284882	55.5
58	0.145526	5.247873	N.A.	N.A.	0.283059	36.1
59	0.240192	7.081751	N.A.	N.A.	2.074070	29.5
60	0.271628	8.046838	N.A.	N.A.	1.236715	29.6
61	0.349784	9.042034	N.A.	N.A.	1.344980	25.9
62	0.470298	10.076522	N.A.	.	1.504786	21.4
63	0.614141	11.365601	N.A.	.	1.903220	18.5
64	0.674149	14.125552	N.A.	.	3.434100	21.0
65	0.730175	16.921644	N.A.	N.A.	3.526267	23.2
66	0.916151	19.373579	1.729482	1.638604	3.368086	21.1
67	1.192847	22.299203	2.069215	2.049256	4.118471	18.7
68	1.472518	24.192609	2.127323	1.238601	3.365924	16.4
69	1.788231	24.102454	1.805064	-0.106988	1.698076	13.5
70	2.222811	26.435071	2.714731	1.840697	4.555428	11.9
71	2.482500	27.839922	4.018282	-0.130931	3.887351	11.2
72	2.813098	28.731404	2.991117	0.713463	3.704580	10.2
73	3.195495	28.090624	2.242377	0.312338	2.554715	8.8
74	3.261752	26.991192	1.949839	0.212481	2.162320	8.3
75	3.283602	28.083745	2.624729	2.124591	4.749320	8.6

SOURCE: FORM 15

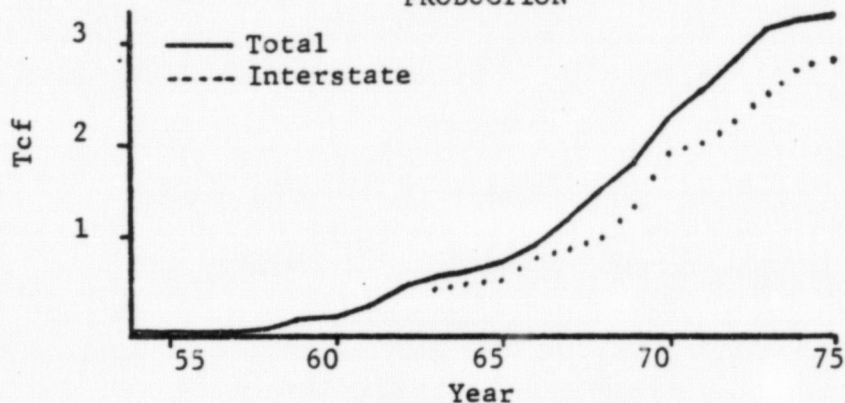
YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	0.176	12.812	N.A.	26.9
64	0.538	13.384	1.110	24.9
65	0.586	15.651	2.853	26.7
66	0.703	17.194	2.246	24.4
67	0.837	19.667	3.309	23.5
68	1.010	22.366	3.709	22.1
69	1.353	25.861	4.848	19.1
70	1.809	27.135	3.083	15.0
71	2.044	25.629	0.539	12.5
72	2.270	26.253	2.894	11.6
73	2.545	25.185	1.478	9.9
74	2.742	22.460	0.017	8.2
75	2.367	18.811	-0.782	6.6

OFFSHORE SOUTH LOUISIANA ZONES 2, 3, 4

RESERVES



PRODUCTION



NUMBER OF GAS WELL 5/ COMPLETIONS

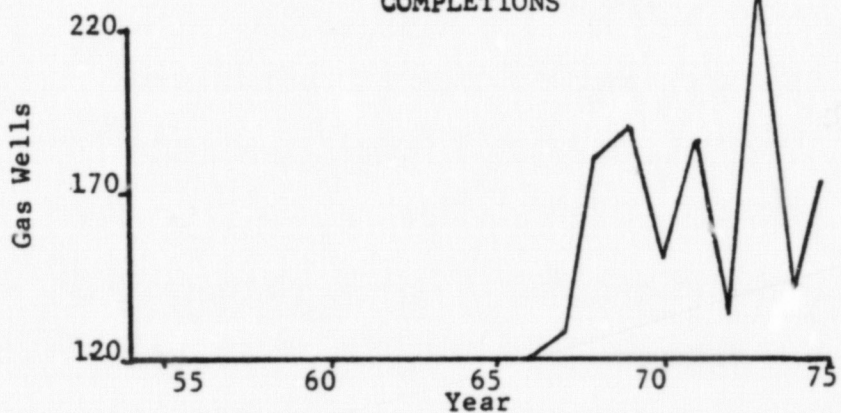


Table 6 G/
TEXAS GULF COAST
(VOLUMES IN TRILLIONS OF CUBIC FEET)

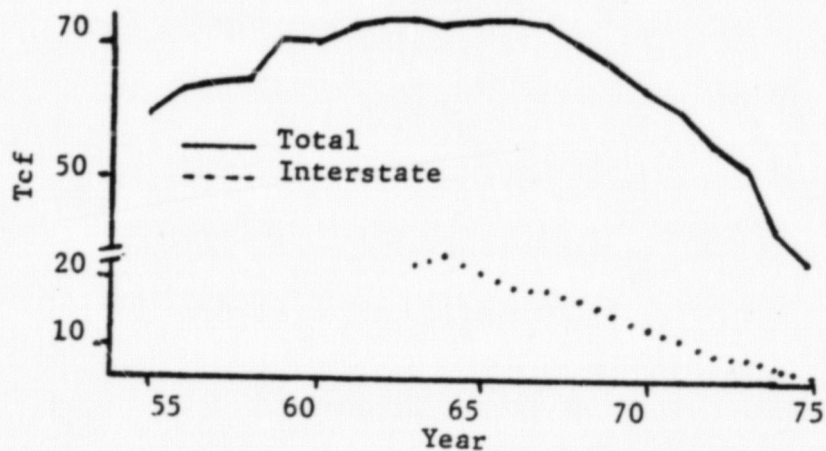
SOURCE: AGA

YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
55	N.A.	59.051166	N.A.	N.A.	N.A.	N.A.
56	2.577701	63.413783	N.A.	N.A.	6.940307	24.6
57	2.590210	64.790846	N.A.	N.A.	3.967280	25.0
58	2.655947	65.044469	N.A.	N.A.	2.909569	24.5
59	2.791371	71.180265	N.A.	N.A.	8.927167	25.5
60	3.034340	70.795225	N.A.	N.A.	2.649299	23.3
61	3.026436	72.984441	N.A.	N.A.	5.215652	24.1
62	3.149661	74.299309	N.A.	N.A.	4.464531	23.6
63	3.289949	74.334368	N.A.	N.A.	3.325007	22.6
64	3.403215	73.629347	N.A.	N.A.	2.698194	21.6
65	3.589888	74.377597	N.A.	N.A.	4.337989	20.7
66	3.750423	74.526225	2.895710	1.003147	3.898857	19.9
67	3.812072	74.022323	2.254573	1.050902	3.305475	19.4
68	3.813779	70.920365	1.084271	-0.381301	0.702970	18.6
69	3.962189	67.540216	1.340837	-0.761435	0.579402	17.0
70	4.047083	64.115555	1.295874	-0.673129	0.622745	15.8
71	3.984091	60.844298	1.214627	-0.499132	0.715495	15.3
72	3.894372	56.147525	1.140800	-1.999490	-0.858690	14.4
73	3.849289	47.865507	1.016635	-5.445640	-4.429005	12.4
74	3.572061	43.176156	1.244394	-2.374380	-1.129986	12.1
75	3.179826	39.438547	1.165623	-1.734372	-0.568749	12.4

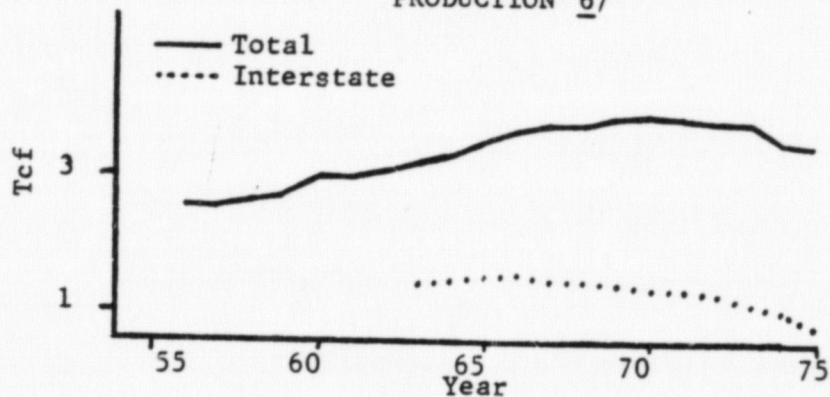
SOURCE: FORM 15

YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	1.839	22.840	N.A.	15.9
64	1.470	23.021	1.651	15.7
65	1.502	21.728	0.209	14.5
66	1.518	19.698	-0.512	13.0
67	1.463	19.527	1.292	13.3
68	1.443	17.127	-0.957	11.9
69	1.301	15.058	-0.668	10.8
70	1.373	12.563	-1.122	9.2
71	1.297	11.348	0.082	8.7
72	1.266	9.242	-0.841	7.3
73	1.142	8.522	0.422	7.5
74	1.042	7.193	-0.287	6.9
75	0.523	5.455	-0.914	6.6

TEXAS GULF COAST 6/ RESERVES



PRODUCTION 6/



NUMBER OF GAS WELL 6/ COMPLETIONS

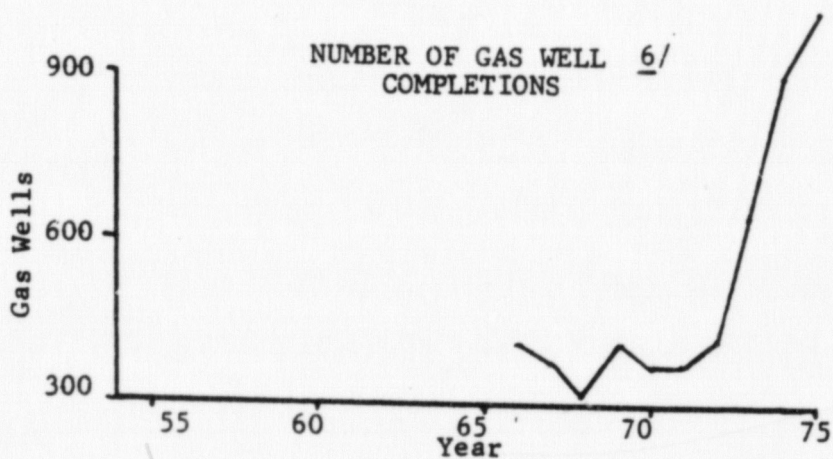


Table 7
HUGOTON-ANADARKO
(VOLUMES IN TRILLIONS OF CUBIC FEET)

SOURCE: AGA

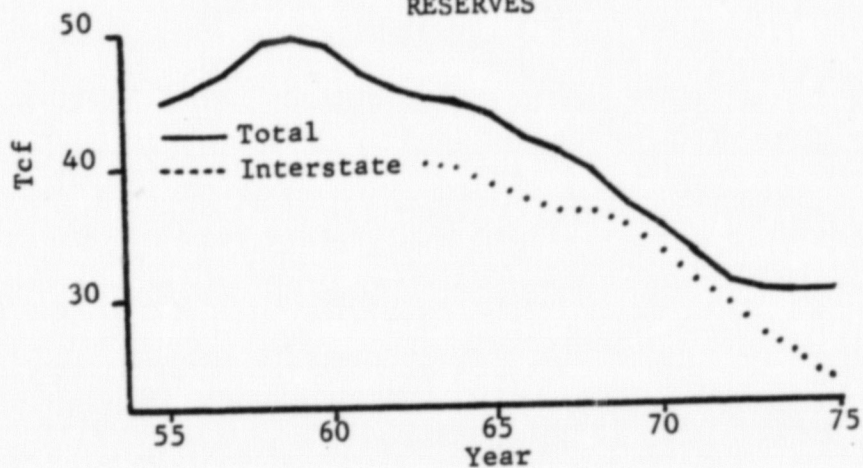
YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
55	N.A.	45.205659	N.A.	N.A.	N.A.	N.A.
56	1.881344	46.385716	N.A.	N.A.	3.051151	24.7
57	1.883551	47.322972	N.A.	N.A.	2.815238	25.1
58	1.819622	49.201455	N.A.	N.A.	3.698058	27.0
59	1.999160	49.431585	N.A.	N.A.	2.217644	24.7
60	2.044748	48.524538	N.A.	N.A.	1.116605	23.7
61	2.176310	47.030637	N.A.	N.A.	0.683422	21.6
62	2.244455	46.495496	N.A.	N.A.	1.700336	20.7
63	2.405816	45.192407	N.A.	N.A.	1.101513	18.8
64	2.582191	44.956745	N.A.	N.A.	2.344176	17.4
65	2.687309	43.548284	N.A.	N.A.	1.272804	16.2
66	2.861569	42.069172	N.A.	N.A.	1.387915	14.7
67	3.001673	41.395977	N.A.	N.A.	2.328630	13.8
68	2.961611	39.121428	N.A.	N.A.	0.675904	13.2
69	3.093682	36.894586	N.A.	N.A.	0.852778	11.9
70	3.299553	35.096990	N.A.	N.A.	1.459618	10.6
71	3.201881	33.299985	N.A.	N.A.	1.395150	10.4
72	3.338960	31.444529	N.A.	N.A.	1.489903	9.4
73	3.383881	30.820984	N.A.	N.A.	2.738755	9.1
74	3.377302	30.406138	N.A.	N.A.	2.978453	9.0
75	3.258828	30.588298	N.A.	N.A.	3.434682	9.4

SOURCE: FORM 15

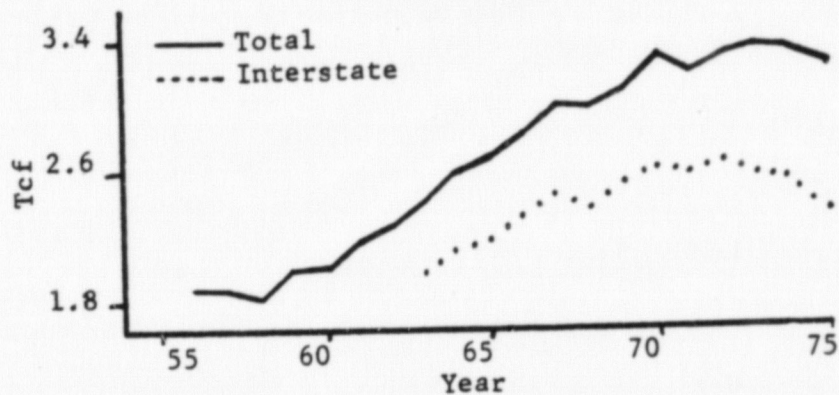
YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	1.962	40.223	N.A.	20.5
64	2.105	39.553	1.435	18.8
65	2.160	38.136	0.744	17.7
66	2.313	37.280	1.457	16.1
67	2.436	36.478	1.634	15.0
68	2.367	36.524	2.414	15.4
69	2.499	35.318	1.292	14.1
70	2.616	33.684	0.983	12.9
71	2.579	31.156	0.051	12.1
72	2.617	28.954	0.414	11.1
73	2.597	26.723	0.357	10.3
74	2.552	25.298	1.127	9.9
75	2.385	23.676	0.764	9.9

HUGOTON - ANADARKO

RESERVES



PRODUCTION



NUMBER OF GAS WELL 7/ COMPLETIONS

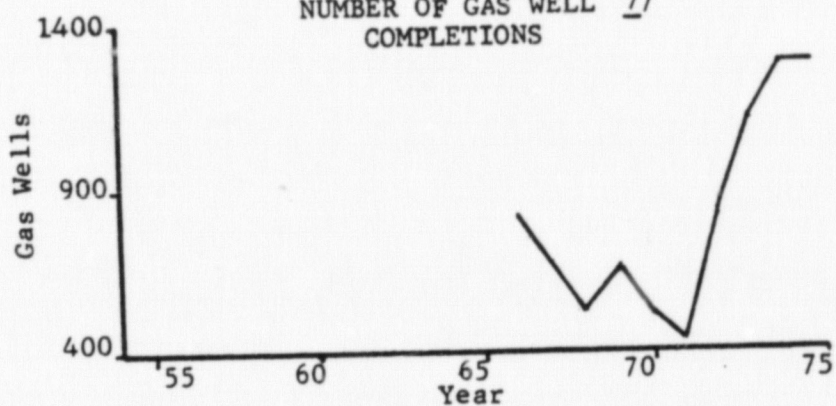


Table 8
PERMIAN BASIN
(VOLUMES IN TRILLIONS OF CUBIC FEET)

SOURCE: AGA

YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
55	N.A.	22.659488	N.A.	N.A.	N.A.	N.A.
56	1.424691	24.294650	N.A.	N.A.	3.092602	17.1
57	1.439034	23.903264	N.A.	N.A.	1.050276	16.6
58	1.411273	24.913125	N.A.	N.A.	2.420289	17.7
59	1.412835	24.990319	N.A.	N.A.	1.491890	17.7
60	1.444686	24.768332	N.A.	N.A.	1.218743	17.1
61	1.480804	23.769401	N.A.	N.A.	0.482007	16.1
62	1.470299	22.561338	N.A.	N.A.	0.254127	15.3
63	1.432849	22.814374	N.A.	N.A.	1.696592	15.9
64	1.647411	24.727997	N.A.	N.A.	3.558192	15.0
65	1.715941	26.727497	N.A.	N.A.	3.716036	15.6
66	1.783819	30.127772	4.518690	0.670599	5.189289	16.9
67	1.797032	32.616943	3.621975	0.666971	4.288946	18.2
68	2.122701	31.963663	1.230961	0.241856	1.472817	15.1
69	2.371182	29.977869	1.304147	-0.915454	0.388693	12.6
70	2.764581	27.695941	1.964988	-1.477323	0.487665	10.0
71	2.864508	26.622622	1.844665	-0.049782	1.794883	9.3
72	3.134232	25.268601	1.877541	-0.092721	1.784820	8.1
73	3.224497	24.503885	1.678510	0.768580	2.447090	7.6
74	3.231479	23.207458	1.437479	0.489331	1.926810	7.2
75	2.813322	20.618377	0.956425	-0.730641	0.225784	7.3

SOURCE: FIRM 15

YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	0.920	18.916	N.A.	20.6
64	1.056	19.801	1.981	18.8
65	1.066	22.801	4.026	21.4
66	1.151	27.194	5.544	23.6
67	1.208	28.989	3.004	24.0
68	1.440	30.178	2.638	20.8
69	1.655	26.428	-2.095	16.0
70	1.800	22.203	-2.415	12.3
71	1.845	20.948	0.589	11.4
72	1.815	18.093	-1.039	10.0
73	1.917	15.428	-0.848	8.5
74	1.729	13.691	-0.008	7.9
75	1.650	11.631	-0.411	7.1

PERMIAN BASIN

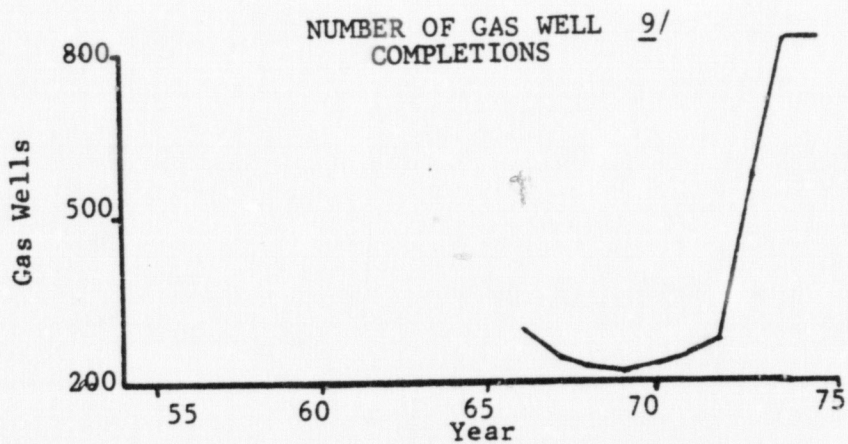
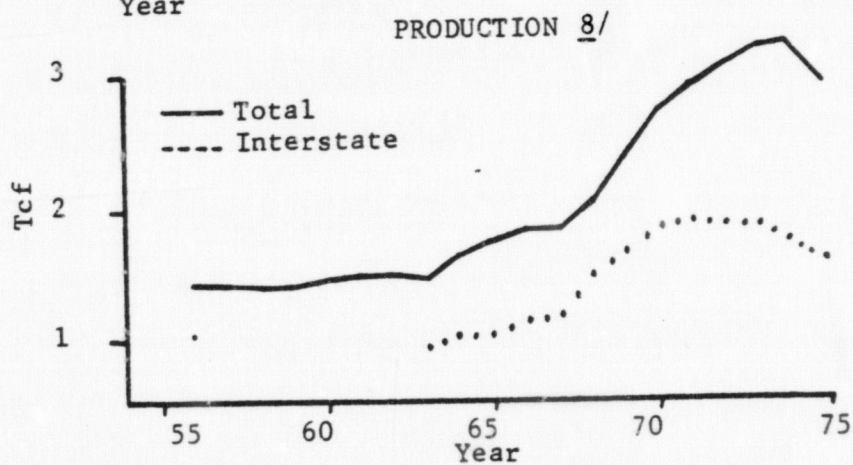
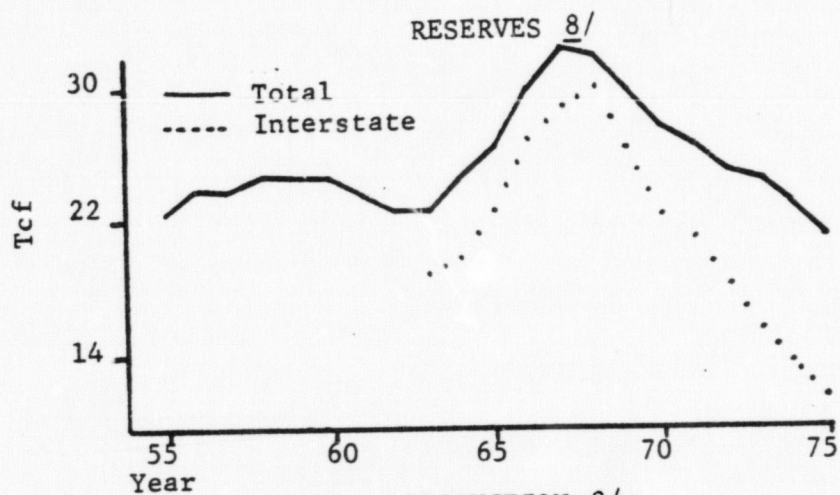


Table 9
OTHER SOUTHWEST
(VOLUMES IN TRILLIONS OF CURIC FEET)

SOURCE: AGA

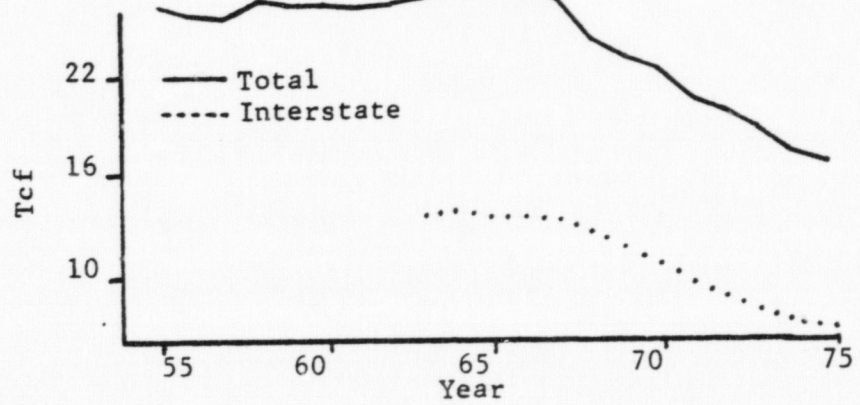
YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
55	N.A.	26.265799	N.A.	N.A.	N.A.	N.A.
56	2.121300	25.728693	N.A.	N.A.	1,585467	12.1
57	2.329101	25.553595	N.A.	N.A.	2,133987	11.0
58	2.192660	26.496847	N.A.	N.A.	3,136705	12.1
59	2.262603	26.275404	N.A.	N.A.	2,025759	11.6
60	2.241543	26.265763	N.A.	N.A.	2,210451	11.7
61	2.112286	26.249409	N.A.	N.A.	2,102811	12.4
62	2.068936	26.379160	N.A.	N.A.	2,184009	12.8
63	2.247681	26.787260	N.A.	N.A.	2,640577	11.9
64	2.203434	27.459794	N.A.	N.A.	2,865858	12.5
65	2.171544	27.553783	N.A.	N.A.	2,257729	12.7
66	2.285199	27.406485	N.A.	N.A.	2,093106	12.0
67	2.184547	26.403808	N.A.	N.A.	1,110897	12.1
68	2.102603	24.235810	N.A.	N.A.	-0,084348	11.5
69	2.152288	23.236084	N.A.	N.A.	1,122190	10.8
70	2.134371	22.303952	N.A.	N.A.	1,142205	10.4
71	1.969871	20.838404	N.A.	N.A.	0,471300	10.6
72	1.810639	19.913162	N.A.	N.A.	0,815045	11.0
73	1.775882	18.821312	N.A.	N.A.	0,678299	10.6
74	1.589816	17.710211	N.A.	N.A.	0,516125	11.1
75	1.457351	16.718235	N.A.	N.A.	0.432439	11.5

SOURCE: FORM 15

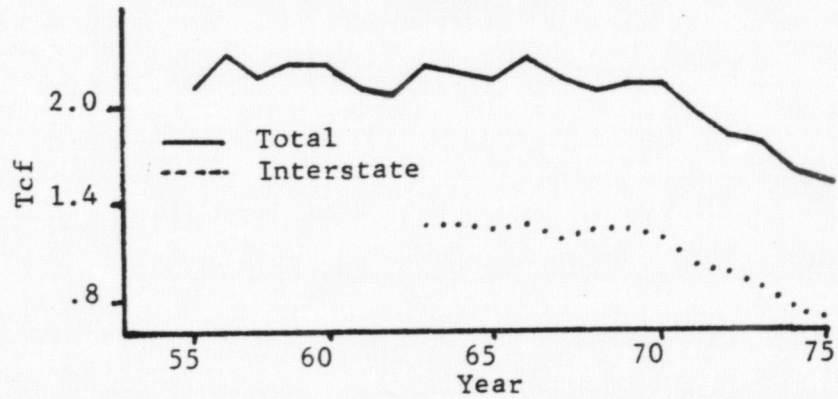
YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	1.254	13.602	N.A.	10.8
64	1.265	13.971	1.634	11.0
65	1.221	13.459	0.708	11.0
66	1.246	13.659	1,444	11.0
67	1.146	13.425	0.953	11.3
68	1.215	12.530	0.319	10.3
69	1.210	11.799	0.479	9.8
70	1.165	10.468	-0.166	9.0
71	1.015	9.478	0.025	9.3
72	0.957	8.779	0.258	9.2
73	0.872	7.936	0.029	9.1
74	0.771	7.243	0.077	9.4
75	0.678	6.568	0.004	9.7

OTHER SOUTHWEST

RESERVES



PRODUCTION



NUMBER OF GAS WELL COMPLETIONS ^{10/}

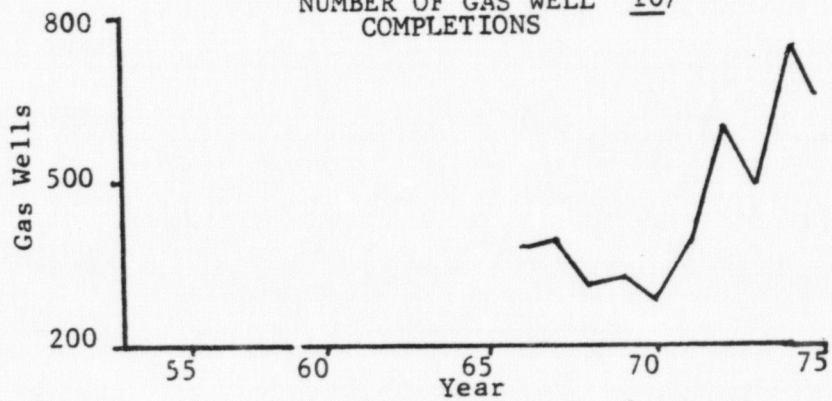


Table 10
 ROCKY MOUNTAIN
 (VOLUMES IN TRILLIONS OF CUBIC FEET)

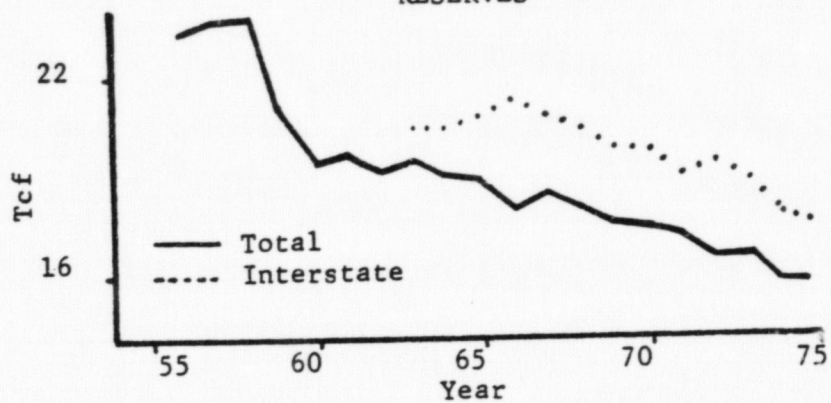
SOURCE: AGA

YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
56	0.509334	23.398545	N.A.	N.A.	4.949725	45.9
57	0.704120	23.736156	N.A.	N.A.	1.035260	33.7
58	0.650013	23.765642	N.A.	N.A.	0.680396	36.6
59	0.727908	21.183990	N.A.	N.A.	-1.857475	29.1
60	0.786831	19.380358	N.A.	N.A.	-1.032554	24.6
61	0.824926	19.698677	N.A.	N.A.	1.143282	23.9
62	0.760997	19.004899	N.A.	N.A.	0.037922	25.0
63	0.761120	19.375252	N.A.	N.A.	1.105690	25.5
64	0.910761	18.934418	N.A.	N.A.	0.454998	20.8
65	0.990721	18.778179	N.A.	N.A.	0.815935	19.0
66	1.070133	17.952849	0.259501	-0.047233	0.212268	16.8
67	1.063954	18.495570	1.582337	0.010862	1.593199	17.4
68	1.138145	17.974665	0.482928	0.114084	0.597012	15.8
69	1.128413	17.514030	0.719260	-0.061357	0.657903	15.5
70	1.106870	17.312785	0.700589	0.196814	0.897403	15.6
71	1.149846	17.087479	0.767210	0.132500	0.899710	14.9
72	1.202692	16.482833	0.755076	-0.168469	0.586607	13.7
73	1.223265	16.577380	1.189670	0.119681	1.309351	13.6
74	1.167371	15.836439	0.862661	-0.399639	0.463022	13.6
75	1.127237	15.694715	1.027418	-0.081867	0.945551	13.9

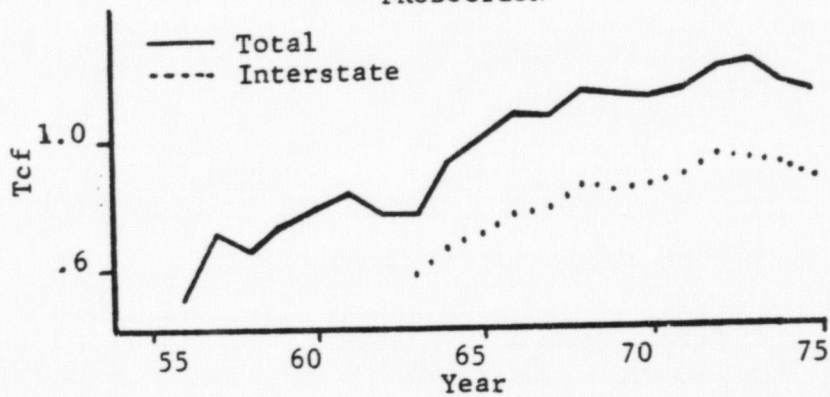
SOURCE: FORM 15

YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	0.570	20.362	N.A.	35.7
64	0.650	20.373	0.661	31.3
65	0.700	20.865	1.192	29.8
66	0.754	21.252	1.140	28.2
67	0.778	20.807	0.373	26.8
68	0.843	20.395	0.391	24.2
69	0.817	19.868	0.289	24.3
70	0.838	19.706	0.677	23.5
71	0.878	18.917	0.089	21.5
72	0.931	19.155	1.169	20.6
73	0.913	18.812	0.571	20.6
74	0.902	17.971	0.061	19.9
75	0.867	17.638	0.535	20.3

ROCKY MOUNTAIN RESERVES



PRODUCTION



NUMBER OF GAS WELL 11/ COMPLETIONS

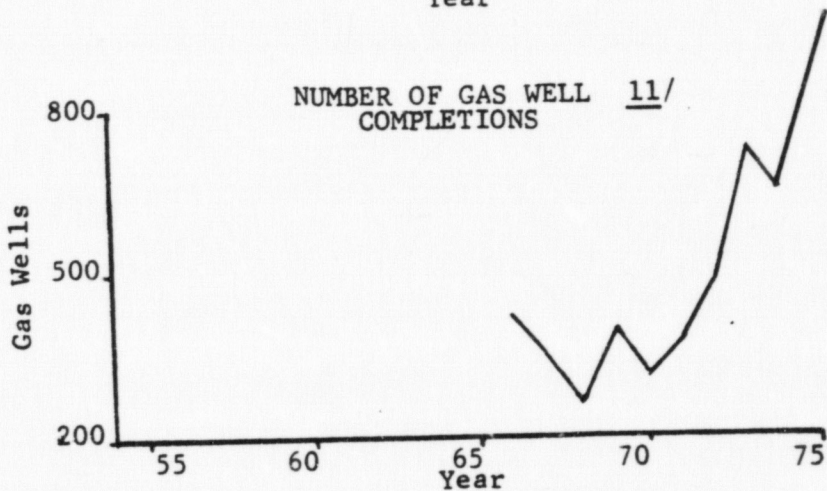


Table 11
APPALACHIA 12/
(VOLUMES IN TRILLIONS OF CUBIC FEET)

SOURCE: AGA

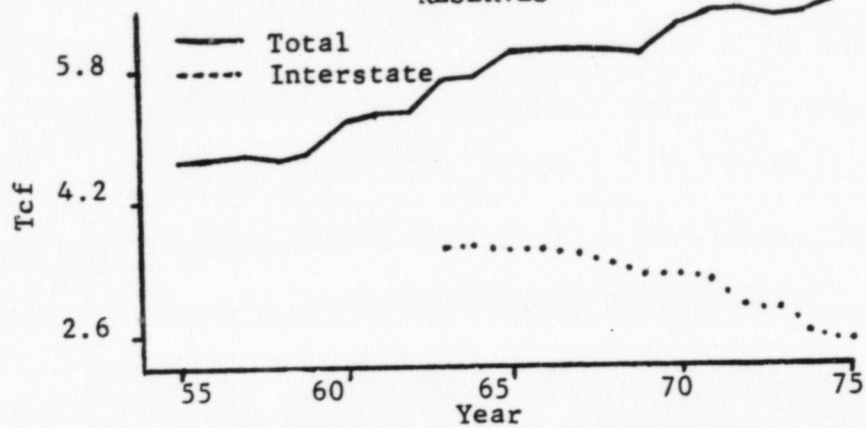
YR	PROD	RESERVES	GROSS R.A.	REVISIONS	NET R.A.	R/P RATIO
55	N.A.	4.709795	N.A.	N.A.	N.A.	N.A.
56	0.434634	4.751721	N.A.	N.A.	0.366453	10.9
57	0.414871	4.812380	N.A.	N.A.	0.396313	11.6
58	0.413710	4.740527	N.A.	N.A.	0.309425	11.5
59	0.431707	4.847459	N.A.	N.A.	0.441043	11.2
60	0.444739	5.207199	N.A.	N.A.	0.694145	11.7
61	0.411303	5.345851	N.A.	N.A.	0.443439	13.0
62	0.383009	5.360349	N.A.	N.A.	0.368924	14.0
63	0.398069	5.691268	N.A.	N.A.	0.653069	14.3
64	0.405004	5.740466	N.A.	N.A.	0.347907	14.2
65	0.416431	5.975942	N.A.	N.A.	0.575367	14.4
66	0.430942	6.139985	0.417803	0.190573	0.608376	14.2
67	0.448270	6.106358	0.368062	0.021655	0.389717	13.6
68	0.450132	6.094077	0.351234	0.035375	0.386609	13.5
69	0.434724	5.970834	0.424371	-0.148202	0.276169	13.7
70	0.459307	6.359066	0.526169	0.017799	0.543968	13.8
71	0.449294	6.501499	0.418028	-0.003129	0.414899	14.5
72	0.426830	6.558130	0.479518	0.021175	0.500693	15.4
73	0.410631	6.413161	0.552460	-0.005446	0.547014	15.6
74	0.411008	6.519605	0.454134	0.130706	0.584840	15.9
75	0.392173	6.804548	0.555630	-0.016027	0.539603	17.4

SOURCE: FORM 15

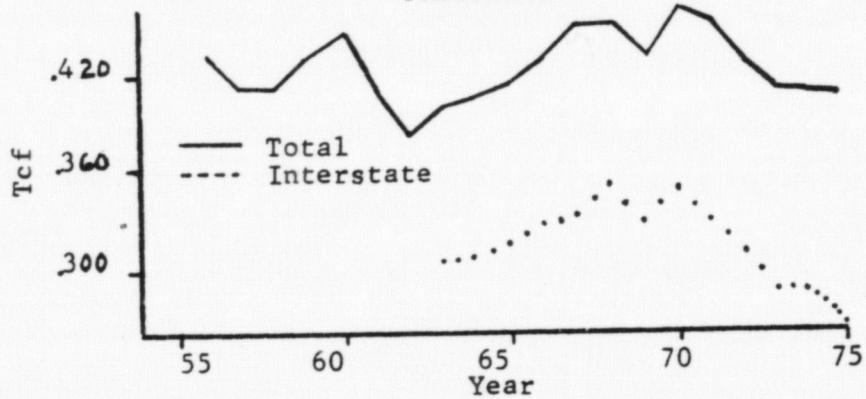
YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	0.304	3.695	N.A.	12.1
64	0.308	3.739	0.352	12.1
65	0.318	3.705	0.284	11.7
66	0.327	3.723	0.345	11.4
67	0.333	3.648	0.258	10.9
68	0.352	3.432	0.136	9.8
69	0.329	3.273	0.170	10.0
70	0.346	3.261	0.334	9.4
71	0.329	3.236	0.304	9.8
72	0.311	2.789	-0.136	9.0
73	0.285	2.776	0.272	9.7
74	0.286	2.616	0.126	9.1
75	0.266	2.530	0.179	9.5

APPALACHIA

RESERVES



PRODUCTION



NUMBER OF GAS WELL ^{13/} COMPLETIONS

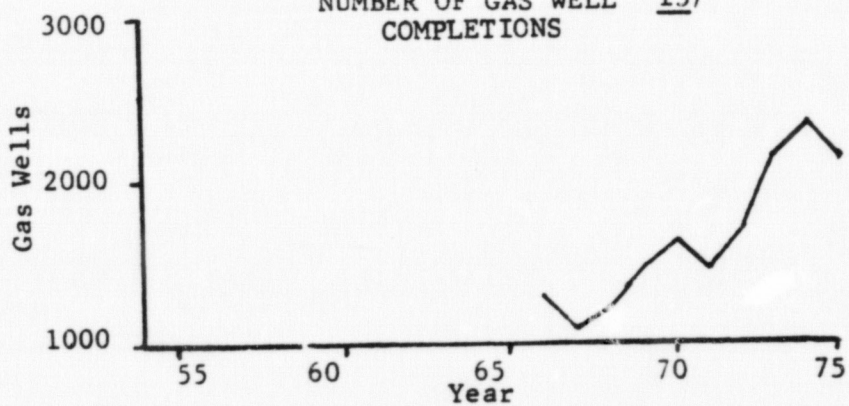


Table 12
ALL OTHER
(VOLUMES IN TRILLIONS OF CUBIC FEET)

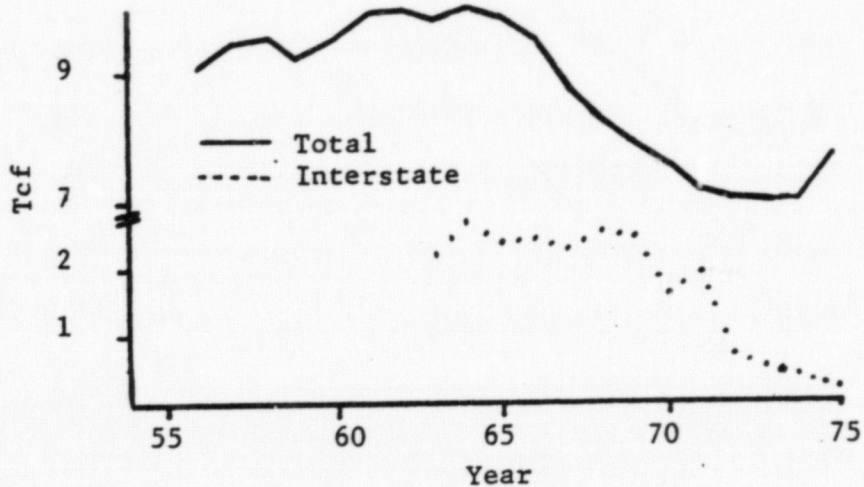
SOURCE: AGA

YR	PROD	RESERVES	GRUSS R.A.	REVISIONS	NET R.A.	R/P RATIO
56	.506249	9.177437	N.A.	N.A.	0.381898	18.1
57	0.491916	9.463590	N.A.	N.A.	0.707949	19.2
58	0.458032	9.551595	N.A.	N.A.	0.520086	20.9
59	0.493799	9.275251	N.A.	N.A.	0.183517	18.8 3/
60	0.533769	9.551744	N.A.	N.A.	0.759237	17.9
61	0.574075	9.903614	N.A.	N.A.	0.864858	17.3
62	0.578499	9.981364	N.A.	N.A.	0.586735	17.3
63	0.654443	9.829050	N.A.	N.A.	0.355735	15.0
64	0.675601	10.091073	N.A.	N.A.	0.879042	14.9
65	0.664527	9.852512	N.A.	N.A.	0.383972	14.8
66	0.729593	9.550147	0.164807	0.181378	0.346185	13.1
67	0.679478	8.807951	0.309039	-0.413965	-0.104946	13.0
68	0.729321	8.394631	0.355345	-0.050877	0.304468	11.5
69	0.704206	8.003636	0.214430	0.080566	0.294996	11.4
70	0.677794	7.638159	0.297054	0.022076	0.319130	11.3
71	0.623014	7.277345	0.295451	-0.096841	0.198610	11.7
72	0.569787	7.163617	0.575525	-0.160006	0.415519	12.6
73	0.561981	7.129872	0.582973	0.063177	0.646150	12.7
74	0.472452	7.193937	0.306975	0.271500	0.578475	15.2
75	0.481870	7.606957	0.394571	0.427329	0.821900	15.8

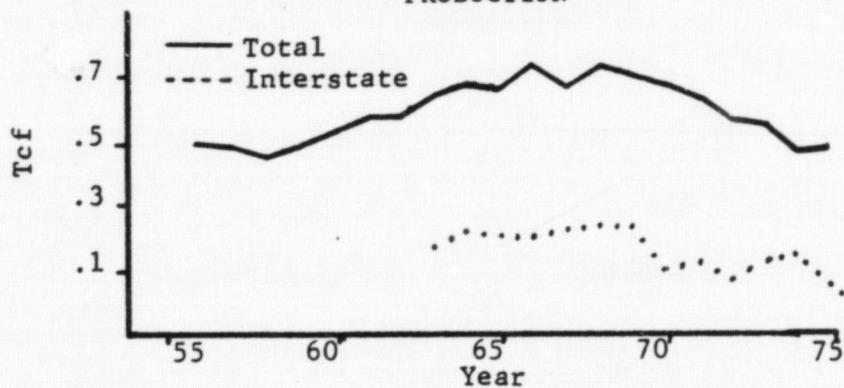
SOURCE: FORM 15

YR	PROD	RESERVES	REVISIONS & ADDITIONS	R/P RATIO
63	0.178	2.354	N.A.	13.2
64	0.212	2.704	0.562	12.8
65	0.206	2.467	-0.031	12.0
66	0.205	2.504	0.242	12.2
67	0.222	2.418	0.136	10.9
68	0.234	2.514	0.430	11.2
69	0.234	2.576	0.196	11.0
70	0.111	1.699	-0.766	15.3
71	0.307	2.155	0.763	7.0
72	0.081	0.751	-1.323	9.3
73	0.124	0.493	-0.134	4.0
74	0.145	0.454	0.106	3.1
75	0.061	0.394	-0.001	6.5

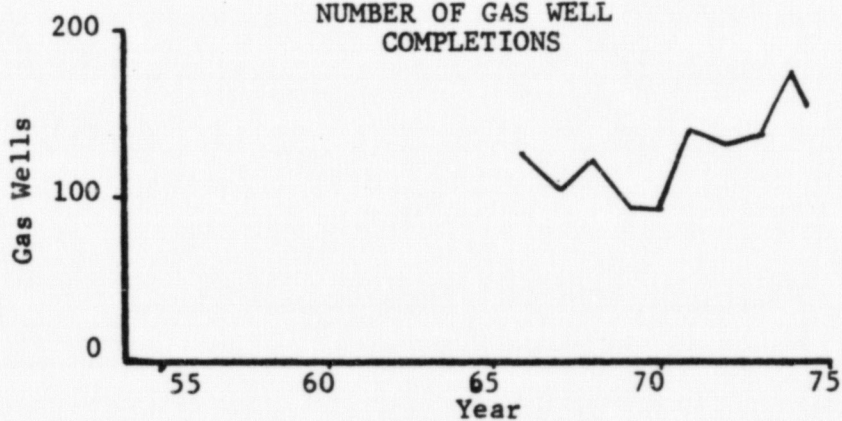
ALL OTHER ^{14/} RESERVES



PRODUCTION



NUMBER OF GAS WELL COMPLETIONS



FOOTNOTES

1/ AGA and Form 15 data consist of total non-associated and associated-dissolved gas.

2/ Drilling statistics are not available to allow an exact geographical match with all of the FPC areas which are the basis of reserve and production compilations. Therefore proxy areas as described by the appropriate footnote have been used to assemble "Number of Gas Well Completions".

"Number of Gas Well Completions" includes total of development and exploratory wells.

These statistics may not include all wells drilled in a given year because AAPG statistical procedures may result in certain wells being held in a "suspense file" until all required well data have been made available. For additional detail see annual AAPG bulletin on North American developments usually published in August.

3/ 1959 AGA data include Alaska.

4/ "Number of Gas Well Completions" includes Onshore South Louisiana only.

5/ "Number of Gas Well Completions" includes Louisiana Offshore Zones 1,2,3, and 4. (State and Federal).

6/ The north portion of Texas Railroad Commission District No. 1 is included in this area for AGA and API data only.

7/ Hugoton-Anadarko proxy area includes Oklahoma, Kansas, and Texas Railroad District 10.

8/ The north portion of Texas Railroad Commission District No. 1 is included in this area for Form 15 data only.

9/ Permian proxy area includes Texas Railroad Districts 7B, 7C, 8, 8A, and Eastern New Mexico.

10/ Other Southwest proxy area includes North Louisiana, Arkansas, Alabama, and Texas Railroad Districts 5,6, and 9.

11/ Rocky Mountain proxy area includes Colorado, Montana, Nebraska, Western New Mexico, North Dakota, South Dakota, Utah, and Wyoming.

FOOTNOTES CONT.

- 12/ Indiana is included in the All Other category for AGA data only.
- 13/ Appalachia proxy area includes Illinois, Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia.
- 14/ All Other includes reserves, production and gas wells not included in the previous area detail.

SOURCES

Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada and United States Productive Capacity (1966-1975), published jointly by AGA, API and CPA.

Special Statements on natural gas reserves and production covering those portions of the FPC pricing areas not specifically identified in the above annual reports (1954-1975), prepared by AGA.

The Gas Supplies of Interstate Natural Gas Pipeline Companies (1964-1975), prepared by the Federal Power Commission.

Annual American Association of Petroleum Geologists Bulletins and American Petroleum Institute Quarterly Review of Drilling Statistics for the United States (1966-1975).

World Oil Forecast - Review Issues: February 15, (1946-1965).

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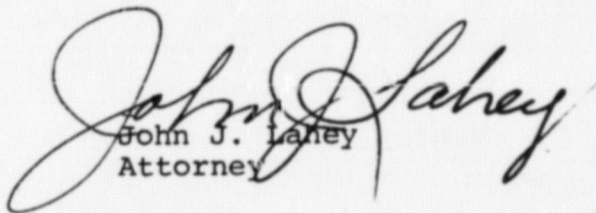
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